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(54) **A METHOD AND PIECE OF EQUIPMENT FOR MANUFACTURING AN AIR HEATING DEVICE, AS WELL AS THE AIR HEATING DEVICE**

VERFAHREN UND VORRICHTUNG ZUR HERSTELLUNG EINER LUFTHEIZUNGSANLAGE SOWIE DIE LUFTHEIZUNGSANLAGE

PROCÉDÉ ET DISPOSITIF DE FABRICATION D'UN APPAREIL DE CHAUFFAGE DE L'AIR, AINSI QUE L'APPAREIL DE CHAUFFAGE DE L'AIR

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Description

[0001] This invention concerns a method and a piece of equipment for manufacturing an air heating device, as well as the air heating device to be used, preferably, in a blow dryer, a hand dryer, an electric heater, a paint remover, or any device operating by the Joule effect.

[0002] This invention, thus, finds application in the small appliances sector and, more precisely, in the production and manufacture of heating components to be inserted inside ventilation ducts, preferably inside one of the devices listed above.

[0003] In the prior art, numerous heating systems are known, for the most part manufactured by winding one or more resistance wires around an insulating support to be housed inside the device's ventilation duct.

[0004] In particular, in these applications, especially those in the more economical range, the insulating support is wound using different resistance windings with different tasks and functions.

[0005] WO 2020/225652 A1 (GAMMA SPA [IT]) 12 November 2020 (2020-11-12) describes an air heating device for a hair dryer, hand dryer, electric heater, paint stripper, and other similar devices for heating air, comprising at least one metal bridge on which an electrical connector is applied, the electrical connector defining a gripping point suitable for retaining the electric wire by interlocking it.

[0006] In most cases, the device comprises two windings, one defining the real resistance that is responsible for heating the flow of air leaving the device (power branch) and the other supplying power to the fan actuation motor using the resistance thereof as a resistance divider (voltage divider branch).

[0007] It should be noted that each winding may be made from a single resistance wire or from several resistance wires connected to each other (in series or in parallel) in order to remodulate the workability and mechanical assembly needs of the structure, achieving the electrical/thermal performance required.

[0008] With reference to the winding of the voltage divider branch, considering that the purpose of the device (blow dryer or the like - editor's note) is to heat air, manufacturers do not generally invest in the use of motor power supply circuits with particularly high performance in terms of thermal dissipation. Instead, they exploit the resistance as a resistance divider, obtaining the double effect of powering the motor to the correct voltage with low circuit costs and exploiting the heating generated by the dissipation of power involved in order to additionally improve the device's heating capacity.

[0009] This clearly entails the need for a suitable positioning both of the main resistance wire and of the motor power supply wire that are both positioned around the resistance support in order to control the temperature thereof.

[0010] Precisely in view of that, some technical solutions involve using a support that, for the most part, is

wound with a first resistance winding, defining the air heating resistance, and which has a second winding made of thin wire arranged electrically in parallel but physically in series to the first winding. In other words, with reference to the extension direction of the support, the heating device has the first resistance winding wound around a "point" portion of the support, which, in use, extends from the air blowing mouth towards the inside of the heating duct, and a second winding defined by a small number of coils composed of an insulating core around which a thin wire is wound and arranged as a "tail" to the support. The two windings, therefore, while being electrically in parallel between them are arranged physically in series, entailing problems of positioning protection devices (thermistor and fusible resistor to begin with).

[0011] In fact, given the configuration of the device, any positioning of the protective members will be a compromise between a quick detection of excessive temperatures between the two windings, with consequent safety risks.

[0012] To avoid these drawbacks, the applicant has, in the past, devised a process for arranging the wires, which involves winding them in conjunction around the support in parallel both electrically and physically/structurally, i.e., producing, in the same step and machine, two coils or helices at a constant pitch that extend together along the support, so that each coil of the first winding is placed between two successive coils of the second winding (and vice versa).

[0013] This makes the structure much safer, since the protective members are always, in any case, arranged within both windings, with the possibility of directly controlling the thermal transients thereof.

[0014] Disadvantageously, in any case, this configuration is much stiffer from the parametric point of view, in fact obliging the producer to change the length of both the resistance wires (together) in case it is wished to change the resistance value of one or the other winding.

[0015] The purpose of this invention is, therefore, to provide a method and a piece of equipment for manufacturing an air heating device, as well as an air heating device that are able to avoid the drawbacks of the prior art cited above.

[0016] In particular, the purpose of this invention is to provide a method and a piece of equipment for manufacturing an air heating device, as well as an air heating device for a blow dryer (or other device operating by Joule effect) that is, at the same time, versatile and safe.

[0017] According to the invention said purposes are achieved with a method according to claim 1 and a piece of equipment for manufacturing an air heating device according to claim 10, as well as an air heating device according to claim 12 for a blow dryer. Embodiments of the invention having are set forth with the appended dependent claims.

[0018] In particular, said purposes are achieved with a method of manufacturing an air heating device com-

prising the steps for arranging a support made of insulating material and extending along a main axis, at least one resistance wire and at least one second resistance wire.

[0019] The at least one first resistance wire is, preferably, helically wound around said support so as to create at least part of a first winding extending along said main axis with a first pitch.

[0020] Depending on the configuration of the circuit, the first winding will, thus, be able to be defined by a single first wire or by several first wires that are electrically in parallel, suitably wound around the support.

[0021] In addition, the at least one second wire is preferably wound around said support so as to create at least part of a second winding extending along said main axis.

[0022] In this case too, depending on the configuration of the circuit, the second winding will, thus, be able to be defined by a single second wire or by several second wires that are electrically in parallel, suitably wound around the support.

[0023] According to one aspect of the invention, the at least one second wire (or, in case there are more, the second wires) is wound around the support so that the second winding comprises at least one first portion and a second portion that can be distinguished from each other.

[0024] The first portion is preferably arranged in parallel, both electrically and physically, to the first winding and has a pitch corresponding to said first pitch, so that there is a coil of the second winding placed between two subsequent coils of the first winding.

[0025] It should be noted that the expression "two subsequent coils" means, in this text, two coils separated by the winding pitch of the same wound wire; for this reason, the configuration of the first portion of the second winding involves a coil of the second winding being placed between two subsequent coils defined by a single first wire.

[0026] The second portion is, in contrast, arranged electrically in series to the first portion and physically in series to the first winding and has a second pitch that is shorter than the first pitch.

[0027] It should be noted that the term "physically" means, in this text, to highlight the physical/structural arrangement of the windings. Two windings "physically in parallel" extend, therefore, around the main axis together, thus occupying the same zone of the insulating support.

[0028] In contrast, two windings arranged "physically in series" are staggered between them along the main axis (i.e., longitudinally), thus winding two different zones of the insulating support (e.g., the "head" and the "tail"). Advantageously, in this way, it is possible to combine all the advantages of the prior art, while avoiding its defects.

[0029] Thanks to the implementation of this method, it is, in fact, possible to ensure the heating device is very safe, with the protective members embedded inside both the windings, therefore managing, to bind, only minimally, the longitudinal dimension (i.e., along the central axis)

of the support with the resistance values of the windings required by the application.

[0030] The subject of this invention is also a piece of equipment for manufacturing an air heating device.

[0031] This piece of equipment comprises a retaining device for an insulating support, said retaining device being provided with at least one rotation component configured to rotate the insulating support around a main axis thereof.

[0032] The piece of equipment preferably comprises a first winding device configured to receive at least one first resistance wire and to release said at least one first resistance wire around said insulating support exploiting the rotation of said rotation component of the retaining device.

[0033] A second winding device is preferably included, which is configured to receive at least one second resistance wire and to release said at least one second resistance wire around said insulating support exploiting the rotation of said rotation component of the retaining device.

[0034] The piece of equipment preferably comprises, in addition, movement means configured to generate a relative movement along said main axis between the retaining device and the winding devices in order to create a first winding, with a first pitch, and a second winding on said insulating support.

[0035] According to one aspect of the invention, the second winding device, the movement means and said rotation component are configured to manufacture said second winding so that it has:

a first portion arranged in parallel, both electrically and physically, to the first winding and having a pitch corresponding to said first pitch, so that there is a coil of the second winding between two subsequent coils of the first winding;

a second portion arranged electrically in series to the first portion and physically in series to the first winding, wherein said second portion has a second pitch that is shorter than the first pitch.

[0036] Advantageously, this piece of equipment manages to produce a resistance in which the two windings, though also physically parallel (with alternating development) at least in the section shared by the first winding and by the first portion of the second, may have resistance values that can vary without excessively impacting the overall dimensions of the device and without reducing the safety level thereof.

[0037] The subject of this invention is, therefore, also an air heating device, preferably for a blow dryer or clothes dryer, comprising a support, a first and second resistance winding.

[0038] The support is made of insulating material and extends (longitudinally) along a main axis thereof.

[0039] The first winding is created by means of at least one first resistance wire helically extending around said

support along said main axis with a first pitch.

[0040] The second winding is created by means of at least one second resistance wire extending along said main axis.

[0041] The second winding preferably comprises a first portion and a second portion that can be distinguished from each other.

[0042] The first portion is arranged in parallel, both electrically and physically, to the first winding and has a pitch corresponding to said first pitch, so that there is a coil of the second winding between two subsequent coils of the first winding.

[0043] The second portion is arranged electrically in series to the first portion and physically in series to the first winding (and to the first portion), wherein said second portion has a second pitch that is shorter than the first pitch. Advantageously, the first portion wound in conjunction (in parallel) with the first winding makes it possible to position the protective members near both resistance wires and, at the same time, the presence of a second portion unbound from the presence of the first winding enables the modulation of the resistance value of the second winding as desired and without significantly impacting the overall length of the support, including in light of the possibility of notably reducing the second pitch compared to the value of the first pitch.

[0044] These and other features, together with their relative advantages, will be clearer from the following exemplary, and therefore non-limiting, description of a preferred, and therefore not exclusive, embodiment of a method and a piece of equipment for manufacturing an air heating device, as well as an air heating device, according to what is illustrated in the attached figures, wherein:

- Figures 1 and 2 respectively show a side view and a perspective view of an air heating device according to this invention, in a first embodiment;
- Figure 3 schematically shows an air heating device according to this invention, in a second embodiment;
- Figures 4-7 schematically show the succession of steps of a manufacturing method for the air heating device in Figure 1, actuated via a piece of equipment for manufacturing the heating device, which is the subject of the invention.

[0045] With reference to the attached figures, the number 1 indicates a device for heating air according to this invention, of the type preferably used inside a blow dryer, a clothes dryer, a hand dryer, an electric heater, a paint dryer, or any device operating by Joule effect.

[0046] The device 1 is of the type commonly defined "resistance" in that it comprises, in addition to an insulating support (better described below), one or more resistance windings that, if traversed by an electric current, are heated so as to raise the temperature of an air flow hitting it. Generally, then, the device 1 for heating air comprises an insulating support 2 around which at least one

resistance wire 3 is wound, which, in use, is hit by an air flow generated by ventilation/blowing means (not illustrated), placed operationally upstream, in order to raise the temperature thereof.

[0047] The insulating support 2 is, thus, a body (monolithic or assembled) made of electrically insulating material, such as mica, plastic, or ceramic.

[0048] This insulating support 2 preferably extends longitudinally along a main axis "A" thereof, or a central axis.

[0049] The length, i.e., the extension of the support 2 along the main axis "A" depends on the housing wherein the device 1 will be positioned in the finished product, i.e., in use.

[0050] In any case, the support preferably has multiple radial partitions 2a angularly spaced apart from each other in order to define multiple angular sectors.

[0051] The radial partitions 2a extend parallel to the main axis "A" and each have a radially outer edge 2b on which the resistance wires of the windings are placed.

[0052] This radially outer edge 2b is preferably indented in order to enable its correct fixing and to encourage the maintenance of the correct position by the resistance wire (or resistance wires).

[0053] The support 2 may have various shapes, preferably at least in part truncated cone or flared in order to adapt to the nozzle of the device housing it.

[0054] In some embodiments, in addition, the support has a tubular shape with a ring or central tube from which the radial partitions 2a extend, moving away from the main axis "A".

[0055] Alternatively, as in the illustrated embodiment, the support 2 may be defined by multiple thin sheets or plates of insulating material fitted together or attached so as to define a star-shaped structure.

[0056] In more detail, this invention preferably refers to a device 1 wherein at least two windings W1, W2 are wound around the insulating support 2, nominally at least a first W1 and at least a second W2 winding.

[0057] The two windings W1, W2, which, in principle, could also be equal in terms of physical features, have different functions within the electrical circuit. One of the windings W1, W2, in fact, has the function of heating the air flow and, therefore, has higher resistance in order to maximise the heating effect.

[0058] The other winding, in contrast, has the function of supplying power to the motor that rotates the blowing fan (not illustrated), the reason for which the dissipated power for heating is to be considered a factor collateral - although, in part, welcome - to its role within the circuit.

[0059] For the purposes of describing this invention, the first winding W1 will be considered the heating one, while the second winding W2 will be considered the motor power supply one.

[0060] It is, however, understood that the two windings could be inverted without, as a result, going beyond the spirit of this invention.

[0061] The first winding W1 is, preferably, defined by

at least one resistance wire 3 helically wound around the support, in particular around the main axis "A".

[0062] This first winding has, therefore, a first winding pitch "p1" defined by the distance, measured along the main axis "A", between two successive coils defined by the first resistance wire 3.

[0063] It should be noted that, in some embodiments, the first winding W1 comprises more than one first wire 3, for example two first wires 3, as schematically illustrated in Figure 3.

[0064] In this embodiment with two first wires 3, they are electrically and physically arranged in parallel, thus defining two helicoids extending parallel along the insulating support 2 and defining, together, the first winding W1.

[0065] In this embodiment, both the first wires 3 are wound around the support 2 with the first winding pitch "p1" (i.e., with an equal pitch) and, preferably, are offset from each other by an axial distance to a fraction of said pitch (in this case 1/3), so as to maintain the heating of the air inside the duct uniform.

[0066] In the preferred embodiment, the first wire 3 (or first wires) is made of iron alloys or nickel and has a diameter that varies depending on the electrical configuration of the circuit. With equal power, a circuit that includes a single first wire 3 will have a wire with a larger cross-section compared to an equivalent circuit provided with two or three first wires, which will have a smaller diameter.

[0067] The first wire 3 preferably has a wavy shape; in other words, the first wire 3 (or first wires) do not extend circumferentially around the support in a linear way, but extend according to a wavy shape in accordance with what is described in the patent IT1289406 belonging to the applicant.

[0068] Therefore, the first winding W1 preferably has multiple coils (or revolutions), each of which contains a prefixed number of waves.

[0069] In the preferred embodiment, the number of waves per coil (or waves/revolution) varies along the winding.

[0070] More preferably, the first winding W1 comprises a first section T1 wherein each coil of said first winding W1 comprises a first number of waves and a second section T2 of the first winding W1 in which each coil of said first winding W1 comprises a second number of waves per revolution.

[0071] The methods for varying the number of waves/revolution are various, but preferably in the context of this invention, a transition coil is used as described and illustrated in the document EP1884962, again in the name of the applicant.

[0072] The second winding W2 is also, preferably, defined by at least one second resistance wire 4 helically wound around the support, in particular around the main axis "A".

[0073] The second resistance wire 4 is preferably made of iron alloys or nickel and has a diameter ranging

between 0.20 and 0.60 mm, more preferably between 0.22 and 0.42 mm.

[0074] According to one aspect of the invention, the second winding W2 comprises a first portion W2' and a second portion W2" that can be distinguished from each other.

[0075] The first portion W2' is arranged in parallel both electrically and physically to the first winding W1 and has a winding pitch corresponding to said first pitch "p1".

[0076] In this way, a coil of the second winding W2 is placed between two subsequent coils of the first winding W1.

[0077] It should be remembered that the expression "two subsequent coils" means, in this text, two coils separated by the winding pitch of the same wound wire; for this reason, the configuration of the first portion of the second winding W2 involves a coil of the second winding W2 being placed between two subsequent coils defined by a single first wire 3.

[0078] In other words, in embodiments wherein the windings are defined by several wires in parallel, it is possible that the coil immediately adjacent to a coil defined by a first wire or by a second wire is again a wire (first or second) belonging to the same winding.

[0079] In any case, this does not mean that this coil defined by the first wire or by the second wire is axially placed between two subsequent coils of a single helicoid (i.e., the winding portion defined by a single wire).

[0080] The second portion W2" is, in contrast, arranged electrically in series to the first portion W2' and physically in series to the first winding W1.

[0081] It should be noted that, preferably, the second portion W2" has a second pitch "p2" that is smaller than the first pitch "p1".

[0082] Advantageously, in this way, it is possible to combine improved planning versatility with compact dimensions and, at the same time, the maintenance of important safety standards.

[0083] It should be noted that, regarding the device 1, it preferably comprises:

- at least one first socket 5a (or connector) from which the first W1 and the second winding branch out,
- at least one second socket 5b (or connector) positioned immediately downstream of the first winding W1 and configured to receive one free end of the first wire 3 (or the free ends of the first wires);
- at least one third socket 5c (or connector) positioned on the opposite side of the support 2 compared to the first socket 5a and downstream of the second portion W2" of the second winding W2 in order to receive one free end of the second wire 4 (or the free ends of the second wires).

[0084] The second pitch "p2" is, preferably, shorter than the distance between two adjacent coils of the first W1 and second windings W2.

[0085] Advantageously, this makes it possible to max-

imise the reduction in size. In the embodiment illustrated, the second pitch "p2" is less than 1/3 of the first pitch "p1".

[0086] It should be noted that the second winding W2 is also, preferably, a wavy wire. The second wire 4 (or second wires) also have a wavy shape along the circumferential extension thereof.

[0087] More preferably, the first portion W2' of the second winding W2 comprises a first section t1 in which each coil comprises a first number of waves and at least one second section t2 in which each coil comprises a third number of waves.

[0088] More preferably, in addition, each coil of the second portion W2" of the second winding W2 comprises a third number of waves.

[0089] The change in number of waves is obtained, as said, according to the methods described in the document EP1884962, again in the name of the applicant.

[0090] Advantageously, this configuration makes it possible to have a second winding with a high variability relative to the number of waves/revolution or waves/coil, making it possible to optimally adapt the planning of the device 1 to the performance needs of the equipment on which it is assembled.

[0091] In any case, the second number of waves per revolution is preferably greater than said first number of waves per revolution, while the third number of waves per revolution (if included) is equal or greater than said second number of waves per revolution.

[0092] It should be noted in this regard, that the first and second number of waves per revolution (or coil) of the first winding could be different from the first and second number of waves per revolution (or coil) of the second winding.

[0093] The subject of this invention is also a piece of equipment for manufacturing an air heating device, preferably, but not necessarily, the heating device 1 described up to this point.

[0094] We will proceed, therefore, below to describe the piece of equipment in more detail, underlining that until now all the features mentioned and described in relation to the device 1, where not expressly identified or if incompatible, are to be considered applicable *mutatis mutandis* to the following description of the piece of equipment that is the subject of this invention.

[0095] The piece of equipment 1 comprises a retaining device 101 for the insulating support 2.

[0096] This retaining device 101 is provided with at least one rotation component 102 configured to rotate said insulating support 2 about its own main axis "A".

[0097] In more detail, there is a clamp or expander wedge configured to retain the support 2 and rotate it.

[0098] There are also a first 103 and a second winding device 104 configured to make the first W1 and the second winding W2.

[0099] The first winding device 103 is configured to receive at least one first resistance wire 3 and to release it around the insulating support 2 by means of the rotation of the rotation component 102.

[0100] Similarly, the second winding device 104 is configured to receive the at least one second resistance wire 4 and to release it around the insulating support 2 by means of the rotation of the rotation component 102.

[0101] It should be noted, in this regard, that there may be just one retaining device 101, connected and connectible to both the winding devices 103, 104 or, alternately, there could be two retaining devices 101, each connected to a winding device 103, 104.

[0102] It should be noted that, in the embodiments wherein the windings are made from more than one resistance wire, the winding devices 103, 104 have two release portions that each apply a corresponding resistance wire.

[0103] Each winding device 103, 104 preferably comprises a folding component configured to receive the corresponding first 3 or second wire 4 and to deform it so as to give it a wavy shape along a corresponding extension direction, in accordance with what was already described above in relation to the device 1 and in patents IT1289406 and EP1884962.

[0104] Movement means 105 configured to generate a relative movement along said main axis "A" between the retaining device 101 (or each retaining device 101) and the winding devices 103, 104 are described.

[0105] The movement means may be defined by a linear actuator (hydraulic or electro-mechanic) connected to the winding devices 103, 104 or to the retaining device 101 or to both.

[0106] Advantageously, in this way, it is possible to coordinate the movements of the devices in order to make a first winding W1 that has a first pitch "p1" and a second winding on the insulating support 2 (i.e., around the insulating support).

[0107] According to one aspect of the invention, the second winding device 104, the movement means 105, and said rotation component 102 are configured to create said second winding W2 with:

a first portion W2' arranged in parallel, both electrically and physically, to the first winding W1 and having a pitch corresponding to said first pitch "p1", so that there is a coil of the second winding W2 between two subsequent coils of the first winding W1;

a second portion W2" arranged electrically in series to the first portion W2' and physically in series to the first winding W1, wherein said second portion W2" has a second pitch "p2" that is shorter than the first pitch "p1".

[0108] Thus, the piece of equipment preferably comprises a control unit (not illustrated) configured to drive the second winding device 104, the movement means 105, and said rotation component 102 according to a first depositing program that has a first release speed of the second winding device 104, a first rotation speed of the rotation component 102, and a first feeding speed along the main axis, wherein the first portion W2' of the second

winding W2 is made.

[0109] This control unit is, in addition, configured to drive the second winding device 104, the movement means 105, and said rotation component 102 according to a second depositing program that has a second release speed of the second winding device 104, a second rotation speed of the rotation component 102, and a second feeding speed along the main axis, wherein the second portion W2" of the second winding W2 is made.

[0110] This first release speed of the second winding device 104, first rotation speed of the rotation component 102, and first feeding speed may be, in part, equivalent to the corresponding second release speed of the second winding device 104, second rotation speed of the rotation component 102, and second feeding speed, depending on the pitch difference and the number of waves/revolution between the first and the second portion of the second winding.

[0111] In the preferred embodiment, the second linear feeding speed is less than the first, so as to allow a reduction in the pitch between the first pitch "p1" and the second pitch "p2".

[0112] Advantageously, this enables great production flexibility, entirely to the advantage of the heating device 1 manufacturer.

[0113] The subject of this invention is also a method of manufacturing an air heating device 1, preferably, but not necessarily, actuated by the piece of equipment described up to this point and of manufacturing the heating device 1 described above.

[0114] We will proceed, therefore, below to describe the method in more detail, underlining that all the features mentioned and described until now in relation to the device 1 and/or piece of equipment, where not expressly identified or if incompatible, are to be considered applicable *mutatis mutandis* to the following description of the piece of equipment that is the subject of this invention.

[0115] The method preferably comprises the steps of arranging the support 2 made of insulating material and extending along a main axis "A", at least one first resistance wire 3 and at least one second resistance wire 3.

[0116] The first resistance wire 3 is, preferably, helically wound around the support 2 so as to create at least part of the first winding W1 extending along said main axis (A) with a first winding pitch "p1".

[0117] The second resistance wire 4 is, thus, helically wound around said support 2 so as to create at least part of a second winding W2 extending along said main axis "A".

[0118] It should be noted that, the reference to "at least part" of the first W1 and second winding W2 refers to the possibility, already mentioned several times in this text, to make the winding with more than one first or second resistance wire so that the first W1 or second winding W2 is at least defined by several helicoids in parallel both electrically and physically.

[0119] It should be noted that, preferably, the winding step of the at least one first wire 3, or the step for making

the first winding W1 is carried out upstream of the winding step for the second resistance wire 4, or upstream of the step for making the second winding W2.

[0120] According to one aspect of the invention, the second winding W2 comprises a first portion W2' and a second portion W2", in accordance with what has already been described.

[0121] The method, therefore, involves making the first portion W2' of the second winding W2, by arranging the second wire 4 in parallel both electrically and physically to the first winding W1 and winding it with a pitch corresponding to said first pitch "p1".

[0122] In this way, between two subsequent coils of the first winding W1 a coil of the second winding W2 is placed.

[0123] The method also involves creating the second portion W2" of the second winding W2 arranging the second wire 4 electrically in series to the first portion W2' and physically in series to the first winding W1.

[0124] It should be noted that, in the step for creating the second portion W2", a second additional part of the second wire 4 is prepared, the first part of which was already, previously, wound parallel to the first winding W1.

[0125] The second portion W2" of the second winding preferably has a second pitch "p2" that is smaller than the first pitch "p1".

[0126] In addition, the method preferably involves performing a step for deforming the first 3 and second 4 resistance wire (or each first 3 or second wire 4) so as to give said first 3 and second 4 wire a wavy shape along a respective extension direction.

[0127] This deforming step is carried out upstream of the corresponding step for winding the first 3 and second 4 resistance wire around the support.

[0128] As already mentioned above, this step is described in the patents IT1289406 and EP1884962.

[0129] In this respect, preferably, the winding step for the first resistance wire 3 involves a first sub-step and second sub-step.

[0130] The first sub-step involves creating the first section T1 of the first winding W1 wherein each coil of said first winding W1 comprises a first number of waves (i.e., first number of waves/revolution).

[0131] The second sub-step involves, in contrast, creating a second section T2 of the first winding W1 wherein each coil of said first winding W1 comprises a second number of waves (i.e., second number of waves/revolution).

[0132] The first number is, preferably, less than the second number of waves per revolution of the first winding W1.

[0133] In addition, the winding step for the second resistance wire 4 also, preferably, involves several sub-steps and, in particular:

- a first sub-step for creating a first section t1 of the first portion W2' of the second winding W2 wherein

each coil of said second winding W2 comprises a first number of waves (i.e., first number of waves/revolution per revolution);

- a second sub-step for creating a second section t2 of the first portion W2' of the second winding W2 wherein each coil of said second winding W2 comprises a second number of waves (i.e., second number of waves/revolution per revolution);

[0134] In addition, there is also, preferably, a third sub-step for creating said second portion W2'' of the second winding W2 wherein each coil of said second winding W2 comprises a third number of waves (i.e., third number of waves/revolution).

[0135] In this case too, the first number of waves per revolution is preferably less than the second number of waves per revolution, which are not necessarily equal (but could be) to the first and second number of waves per revolution of the first winding W1.

[0136] More preferably, the third number of waves per revolution is equal or greater to the second number of waves per revolution.

[0137] The invention achieves the purposes proposed and entails significant advantages.

[0138] In fact, the provision of a method and a device wherein the windings of the power and partition branch are in a hybrid series/parallel configuration (in terms of physics/geometry) makes it possible to minimise the overall dimensions while maintaining high standards of safety and, at the same time, granting enormous planning versatility.

[0139] In other words, thanks to the method that is the subject of this invention, it is enough for the producer to modulate the feeding and rotation parameters of the production stations in order to vary the performance of the device in accordance with the customer's specifications, without modifying, in substance, the layout of the resistance.

Claims

1. A method of manufacturing an air heating device (1), comprising the steps of:

- preparing a support (2) made of insulating material and extending along a main axis (A);
- preparing at least one first resistance wire (3);
- preparing at least one second resistance wire (4);
- helically winding said at least one first resistance wire (3) around said support (2) so as to create at least part of a first winding (W1) extending along said main axis (A) with a first pitch (p1);
- helically winding said at least one second resistance wire (4) around said support (2) so as to create at least part of a second winding (W2)

extending along said main axis (A);

characterised in that the second winding (W2) comprises:

a first portion (W2') arranged in parallel, both electrically and physically, to the first winding (W1) and having a pitch corresponding to said first pitch (p1), so that there is a coil of the second winding (W2) between two subsequent coils of the first winding (W1);
a second portion (W2'') arranged electrically in series to the first portion (W2') and physically in series to the first winding (W1), wherein said second portion (W2'') has a second pitch (p2) that is shorter than the first pitch (p1).

2. The method according to claim 1, wherein said second pitch (p2) is shorter than the distance between two adjacent coils of the first (W1) and second windings (W2).
3. The method according to claim 1 or 2, wherein said second pitch (p2) is shorter than 1/3 of the first pitch.
4. The method according to any one of claims 1 to 3, wherein said steps for winding the first wire (3) are performed upstream of the step for winding the second resistance wire (4).
5. The method according to any one of the previous claims, comprising a step for deforming the first (3) and the second resistance wire (4) so as to give said first (3) and second wire (4) a wavy shape along a respective extension direction; said deforming step being performed upstream of the corresponding step for winding the first (3) and the second resistance wire (4) around the support.
6. The method according to claim 5, wherein said step for winding the first resistance wire (3) involves:

- a first sub-step for creating a first section (T1) of the first winding (W1) wherein each coil of said first winding (W1) comprises a first number of waves;
- a second sub-step for creating a second section (T2) of the first winding (W1) wherein each coil of said first winding (W1) comprises a second number of waves.

7. The method according to claim 5 or 6, wherein said step for winding the second resistance wire (4) involves:

- a first sub-step for creating a first section (t1) of the first portion (W2') of the second winding (W2) wherein each coil of said second winding

- (W2) comprises a first number of waves;
 - a second sub-step for creating a second section (t2) of the first portion (W2') of the second winding (W2) wherein each coil of said second winding (W2) comprises a second number of waves;
 - a third sub-step for creating said second portion (W2'') of the second winding (W2) wherein each coil of said second winding (W2) comprises a third number of waves.
8. The method according to claim 6 or 7, wherein said second number of waves per revolution is greater than said first number of waves per revolution.
9. The method according to claim 7 or 8, wherein said third number of waves per revolution is equal to or greater than said second number of waves per revolution.
10. A piece of equipment for manufacturing an air heating device, comprising:
- a retaining device (101) for an insulating support (2) provided with at least one rotation component (102) configured to rotate said insulating support (2) about its own main axis (A);
 - a first winding device (103) configured to receive at least one first resistance wire (3) and to release said at least one first resistance wire (3) around said insulating support (2) by means of the rotation of said rotation component (102) of the retaining device (101);
 - a second winding device (104) configured to receive at least one second resistance wire (4) and to release said at least one second resistance wire (4) around said insulating support (2) by means of the rotation of said rotation component (102) of the retaining device (101);
 - movement means (105) configured to generate a relative movement along said main axis (A) between the retaining device (101) and the winding devices (103, 104) in order to create a first winding (W1), with a first pitch (p1), and a second winding (W2) on said insulating support (2); wherein said second winding device (104), said movement means (105), and said rotation component (102) are configured to create said second winding (W2) with:
- a first portion (W2') arranged in parallel, both electrically and physically, to the first winding (W1) and having a pitch corresponding to said first pitch (p1), so that there is a coil of the second winding (W2) between two subsequent coils of the first winding (W1);
 - a second portion (W2'') arranged electrically in series to the first portion (W2') and physically in series to the first winding (W1), wherein said second portion (W2'') has a second pitch (p2) that is shorter than the first pitch (p1).
11. The piece of equipment according to claim 10, wherein said first (103) and second winding device (104) each comprise a bending component configured for:
- respectively receiving said at least one first (3) or second wire (4);
 - deforming said at least one first (3) or said at least one second wire (4) so as to give it a wavy shape along a corresponding extension direction.
12. An air heating device, preferably for a device operating by the Joule effect, comprising:
- a support (2) made of insulating material and extending along a main axis (A);
 - a first winding (W1) created by means of at least one first resistance wire (3) helically extending around said support (2) along said main axis (A) and having a first winding pitch (p1);
 - a second winding (W2) created by means of at least one second resistance wire (4) and extending along said main axis (A);
- characterised in that** the second winding (W2) comprises:
- a first portion (W2') arranged in parallel, both electrically and physically, to the first winding (W1) and having a pitch corresponding to said first pitch (p1), so that there is a coil of the second winding (W2) between two subsequent coils of the first winding (W1);
 - a second portion (W2'') arranged electrically in series to the first portion (W2') and physically in series to the first winding (W1), wherein said second portion (W2'') has a second pitch (p2) that is shorter than the first pitch (p1).

Patentansprüche

1. Verfahren zur Herstellung einer Luftheizungsanlage (1), das die folgenden Schritte umfasst:
- Vorbereitung eines Trägers (2), der aus Isoliermaterial hergestellt ist und entlang einer Hauptachse (A) verläuft;
 - Vorbereitung mindestens eines ersten Widerstandsdrahts (3);
 - Vorbereitung mindestens eines zweiten Wider-

standsdrahts (4);

- spiralförmiges Wickeln des genannten mindestens einen ersten Widerstandsdrahts (3) um den genannten Träger (2), um mindestens einen Teil einer ersten Wicklung (W1) zu bilden, die entlang der genannten Hauptachse (A) mit einer ersten Steigung (p1) verläuft;

- spiralförmiges Wickeln des genannten mindestens einen zweiten Widerstandsdrahts (4) um den genannten Träger (2), um mindestens einen Teil einer zweiten Wicklung (W2) zu bilden, die entlang der genannten Hauptachse verläuft;

dadurch gekennzeichnet, dass die zweite Wicklung (W2) Folgendes umfasst:

einen ersten Teil (W2'), der, sowohl elektrisch als auch physisch, parallel zu der ersten Wicklung (W1) angeordnet ist und eine der genannten ersten Steigung (p1) entsprechende Steigung aufweist, so dass sich eine Spule der zweiten Wicklung (W2) zwischen zwei aufeinanderfolgenden Spulen der ersten Wicklung (W1) befindet;

einen zweiten Teil (W2''), der elektrisch in Reihe mit dem ersten Teil (W2') und physisch in Reihe mit der ersten Wicklung (W1) angeordnet ist, wobei der genannte zweite Teil (W2'') eine zweite Steigung (p2) aufweist, die kürzer als die erste Steigung (p1) ist.

2. Verfahren nach Anspruch 1, wobei die genannte zweite Steigung (p2) kürzer ist als der Abstand zwischen zwei angrenzenden Spulen der ersten (W1) und zweiten Wicklungen (W2).

3. Verfahren nach Anspruch 1 oder 2, wobei die genannte zweite Steigung (p2) 1/3 kürzer als die erste Steigung ist.

4. Verfahren nach einem beliebigen der Ansprüche 1 bis 3, wobei die genannten Schritte zum Wickeln des ersten Drahts (3) dem Schritt des Wickelns des zweiten Widerstandsdrahts (3) vorgelagert erfolgen.

5. Verfahren nach einem beliebigen der vorangegangenen Ansprüche, umfassend einen Schritt zur Verformung des ersten (3) und des zweiten Widerstandsdrahts (4), um dem genannten ersten (3) und zweiten Draht (4) entlang einer entsprechenden Verlaufsrichtung eine Wellenform zu verleihen; wobei der genannte Verformungsschritt dem entsprechenden Schritt zum Wickeln des ersten (3) und des zweiten Widerstandsdrahts (4) um den Träger vorgelagert erfolgt.

6. Verfahren nach Anspruch 5, wobei der genannte Schritt zum Wickeln des ersten Widerstandsdrahts

(3) Folgendes einschließt:

- einen ersten Unterschnitt zur Schaffung eines ersten Abschnitts (T1) der ersten Wicklung (W1), wobei jede Spule der genannten ersten Wicklung (W1) eine erste Anzahl Wellen umfasst;

- einen zweiten Unterschnitt zur Schaffung eines zweiten Abschnitts (T2) der ersten Wicklung (W1), wobei jede Spule der genannten ersten Wicklung (W1) eine zweite Anzahl Wellen umfasst.

7. Verfahren nach Anspruch 5 oder 6, wobei der genannte Schritt zum Wickeln des zweiten Widerstandsdrahts (4) Folgendes einschließt:

- einen ersten Unterschnitt zur Schaffung eines ersten Abschnitts (t1) des ersten Teils (W2') der zweiten Wicklung (W2), wobei jede Spule der genannten zweiten Wicklung (W2) eine erste Anzahl Wellen umfasst;

- einen zweiten Unterschnitt zur Schaffung eines zweiten Abschnitts (t2) des ersten Teils (W2') der zweiten Wicklung (W2), wobei jede Spule der genannten zweiten Wicklung (W2) eine zweite Anzahl Wellen umfasst;

- einen dritten Unterschnitt zur Schaffung eines zweiten Teils (W2'') der zweiten Wicklung (W2), wobei jede Spule der genannten zweiten Wicklung (W2) eine dritte Anzahl Wellen umfasst.

8. Verfahren nach Anspruch 6 oder 7, wobei die genannte zweite Anzahl Wellen pro Umdrehung größer als die genannte erste Anzahl Wellen pro Umdrehung ist.

9. Verfahren nach Anspruch 7 oder 8, wobei die genannte dritte Anzahl Wellen pro Umdrehung gleich oder größer als die genannte zweite Anzahl Wellen pro Umdrehung ist.

10. Ausrüstungsgegenstand zur Herstellung einer Luftheizungsanlage, umfassend:

- eine Rückhaltevorrückung (101) für einen Isolierträger (2), die mit mindestens einer Drehkomponente (102) ausgestattet ist, die darauf ausgelegt ist, den genannten Isolierträger (2) um seine Hauptachse (A) zu drehen;

- eine erste Wicklungsvorrichtung (103), die darauf ausgelegt ist, mindestens einen ersten Widerstandsdraht (3) aufzunehmen und den genannten mindestens einen ersten Widerstandsdraht (3) um den genannten Isolierträger (2) mittels Drehung der genannten Drehkomponente (102) der genannten Rückhaltevorrückung (101) auszugeben;

- eine zweite Wicklungsvorrichtung (104), die darauf ausgelegt ist, mindestens einen zweiten Widerstandsdraht (4) aufzunehmen und den genannten mindestens einen zweiten Widerstandsdraht (4) um den genannten Isolierträger (2) mittels Drehung der genannten Drehkomponente (102) der Rückhaltevorrichtung (101) auszugeben;
- Bewegungselemente (105), die darauf ausgelegt sind, eine relative Bewegung entlang der genannten Hauptachse (A) zwischen der Rückhaltevorrichtung (101) und den Wicklungsvorrichtungen (103, 104) zu erzeugen, um eine erste Wicklung (W1), mit einer ersten Steigung (p1), und eine zweite Wicklung (W2) auf dem genannten Isolierträger (2) zu bilden;

wobei die genannte zweite Wicklungsvorrichtung (104), die genannten Bewegungselemente (105) und die genannte Drehkomponente (102) darauf ausgelegt sind, die genannte zweite Wicklung (W2) zu bilden, und zwar umfassend:

- einen ersten Teil (W2'), der, sowohl elektrisch als auch physisch, parallel zu der ersten Wicklung (W1) angeordnet ist und eine der genannten ersten Steigung (p1) entsprechende Steigung aufweist, so dass sich eine Spule der zweiten Wicklung (W2) zwischen zwei aufeinanderfolgenden Spulen der ersten Wicklung (W1) befindet;
- einen zweiten Teil (W2''), der elektrisch in Reihe mit dem ersten Teil (W2') und physisch in Reihe mit der ersten Wicklung (W1) angeordnet ist, wobei der genannte zweite Teil (W2'') eine zweite Steigung (p2) aufweist, die kürzer als die erste Steigung (p1) ist.

11. Ausrüstungsgegenstand nach Anspruch 10, wobei die genannte erste (103) und zweite Wicklungsvorrichtung (104) jeweils eine Biegekomponente umfassen, die auf Folgendes ausgelegt ist:

- jeweils das Aufnehmen des genannten mindestens einen ersten (3) oder zweiten Drahts (4);
- Verformung des genannten mindestens einen ersten (3) oder des genannten mindestens einen zweiten Drahts (4), um ihm entlang einer entsprechenden Verlaufsrichtung eine Wellenform zu verleihen.

12. Eine Luftheizungsanlage, vorzugsweise für eine nach dem Stromwärmegesetz arbeitende Vorrichtung, umfassend:

- einen Träger (2), der aus Isoliermaterial hergestellt ist und entlang einer Hauptachse (A)

verläuft;

- eine erste Wicklung (W1), die mittels des mindestens einen ersten Widerstandsdrahts (3) gebildet wird, die schraubenförmig um den genannten Träger (2) entlang der genannten Hauptachse (A) verläuft und eine erste Wicklungssteigung (p1) aufweist;
- eine zweite Wicklung (W2), die mittels eines zweiten Widerstandsdrahts (4) gebildet wird und entlang der genannten Hauptachse (A) verläuft;

dadurch gekennzeichnet, dass die zweite Wicklung (W2) Folgendes umfasst:

- einen ersten Teil (W2'), der, sowohl elektrisch als auch physisch, parallel zu der ersten Wicklung (W1) angeordnet ist und eine der genannten ersten Steigung (p1) entsprechende Steigung aufweist, so dass sich eine Spule der zweiten Wicklung (W2) zwischen zwei aufeinanderfolgenden Spulen der ersten Wicklung (W1) befindet;
- einen zweiten Teil (W2''), der elektrisch in Reihe mit dem ersten Teil (W2') und physisch in Reihe mit der ersten Wicklung (W1) angeordnet ist, wobei der genannte zweite Teil (W2'') eine zweite Steigung (p2) aufweist, die kürzer als die erste Steigung (p1) ist.

Revendications

1. Procédé de fabrication d'un appareil de chauffage de l'air (1), comprenant les étapes consistant à :

- préparer un support (2) constitué de matériau isolant et s'étendant le long d'un axe principal (A);
- préparer au moins un premier fil résistif (3);
- préparer au moins un deuxième fil résistif (4);
- enrouler hélicoïdalement ledit au moins un premier fil résistif (3) autour dudit support (2) de manière à créer au moins une partie d'un premier enroulement (W1) s'étendant le long dudit axe principal (A) avec un premier pas (p1) ;
- enrouler hélicoïdalement ledit au moins un deuxième fil résistif (4) autour dudit support (2) de manière à créer au moins une partie d'un deuxième enroulement (W2) s'étendant le long dudit axe principal (A) ;

caractérisé en ce que le deuxième enroulement (W2) comprend :

- une première portion (W2') agencée en parallèle, à la fois électriquement et physiquement, par rapport au premier enroulement (W1) et ayant un pas correspondant audit premier pas (p1),

- de sorte qu'il y ait une bobine du deuxième enroulement (W2) entre deux bobines successives du premier enroulement (W1);
une deuxième portion (W2'') agencée électriquement en série par rapport à la première portion (W2') et physiquement en série par rapport au premier enroulement (W1), dans lequel ladite deuxième portion (W2'') a un deuxième pas (p2) qui est plus court que le premier pas (p1).
2. Procédé selon la revendication 1, dans lequel ledit deuxième pas (p2) est plus court que la distance entre deux bobines adjacentes du premier (W1) et du deuxième enroulements (W2).
 3. Procédé selon la revendication 1 ou 2, dans lequel ledit deuxième pas (p2) est plus court que 1/3 du premier pas.
 4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel lesdites étapes d'enroulement du premier fil (3) sont effectuées en amont de l'étape d'enroulement du deuxième fil résistif (3).
 5. Procédé selon l'une quelconque des revendications précédentes, comprenant une étape de déformation du premier (3) et du deuxième fil résistif (4) de manière à donner audit premier (3) et deuxième fil (4) une forme ondulée le long d'une direction d'extension respective ; ladite étape de déformation étant effectuée en amont de l'étape correspondante d'enroulement du premier (3) et du deuxième fil résistif (4) autour du support.
 6. Procédé selon la revendication 5, dans lequel ladite étape d'enroulement du premier fil résistif (3) prévoit :
 - une première sous-étape de création d'une première section (T1) du premier enroulement (W1) dans laquelle chaque bobine dudit premier enroulement (W1) comprend un premier nombre d'ondes ;
 - une deuxième sous-étape de création d'une deuxième section (T2) du premier enroulement (W1) dans laquelle chaque bobine dudit premier enroulement (W1) comprend un deuxième nombre d'ondes.
 7. Procédé selon la revendication 5 ou 6, dans lequel ladite étape d'enroulement du deuxième fil résistif (4) prévoit :
 - une première sous-étape de création d'une première section (t1) de la première portion (W2') du deuxième enroulement (W2) dans laquelle chaque bobine dudit deuxième enroulement (W2) comprend un premier nombre d'ondes ;
 - une deuxième sous-étape de création d'une deuxième section (t2) de la première portion (W2') du deuxième enroulement (W2) dans laquelle chaque bobine dudit deuxième enroulement (W2) comprend un deuxième nombre d'ondes ;
 - une troisième sous-étape de création de ladite deuxième portion (W2'') du deuxième enroulement (W2) dans laquelle chaque bobine dudit deuxième enroulement (W2) comprend un troisième nombre d'ondes.
 8. Procédé selon la revendication 6 ou 7, dans lequel ledit deuxième nombre d'ondes par tour de rotation est supérieur audit premier nombre d'ondes par tour de rotation.
 9. Procédé selon la revendication 7 ou 8, dans lequel ledit troisième nombre d'ondes par tour de rotation est égal ou supérieur audit deuxième nombre d'ondes par tour de rotation.
 10. Pièce d'équipement pour la fabrication d'un appareil de chauffage de l'air, comprenant :
 - un appareil de retenue (101) pour un support isolant (2) pourvu d'au moins un composant de rotation (102) configuré pour faire tourner ledit support isolant (2) autour de son propre axe principal (A) ;
 - un premier appareil d'enroulement (103) configuré pour recevoir au moins un premier fil résistif (3) et pour libérer ledit au moins un premier fil résistif (3) autour dudit support isolant (2) au moyen de la rotation dudit composant de rotation (102) de l'appareil de retenue (101) ;
 - un deuxième appareil d'enroulement (104) configuré pour recevoir au moins un deuxième fil résistif (4) et pour libérer ledit au moins un deuxième fil résistif (4) autour dudit support isolant (2) au moyen de la rotation dudit composant de rotation (102) de l'appareil de retenue (101) ;
 - des moyens de mouvement (105) configurés pour générer un mouvement relatif le long dudit axe principal (A) entre l'appareil de retenue (101) et les appareils d'enroulement (103, 104) afin de créer un premier enroulement (W1), avec un premier pas (p1), et un deuxième enroulement (W2) sur ledit support isolant (2) ;

dans laquelle ledit deuxième appareil d'enroulement (104), lesdits moyens de mouvement (105), et ledit composant de rotation (102) sont configurés pour créer ledit deuxième enroulement (W2) avec :

 - une première portion (W2') agencée en parallèle, à la fois électriquement et physiquement, par

rapport au premier enroulement (W1) et ayant un pas correspondant audit premier pas (p1), de sorte qu'il y ait une bobine du deuxième enroulement (W2) entre deux bobines successives du premier enroulement (W1); 5
 une deuxième portion (W2'') agencée électriquement en série par rapport à la première portion (W2') et physiquement en série par rapport au premier enroulement (W1), dans lequel ladite deuxième portion (W2'') a un deuxième pas (p2) 10
 qui est plus court que le premier pas (p1).

11. Pièce d'équipement selon la revendication 10, dans laquelle ledit premier (103) et deuxième appareil d'enroulement (104) comprennent chacun un composant de flexion configuré pour : 15

- recevoir respectivement ledit au moins un premier (3) ou deuxième fil (4) ;
- déformer ledit au moins un premier (3) ou ledit 20
 au moins un deuxième fil (4) de manière à lui donner une forme ondulée le long d'une direction d'extension correspondante.

12. Appareil de chauffage de l'air, de préférence pour un appareil fonctionnant par effet Joule, comprenant : 25

- un support (2) constitué de matériau isolant et s'étendant le long d'un axe principal (A) ; 30
- un premier enroulement (W1) créé au moyen d'au moins un premier fil résistif (3) s'étendant hélicoïdalement autour dudit support (2) le long dudit axe principal (A) et ayant un premier pas d'enroulement (p1) ; 35
- un deuxième enroulement (W2) créé au moyen d'au moins un deuxième fil résistif (4) s'étendant le long dudit axe principal (A) ;

caractérisé en ce que le deuxième enroulement (W2) comprend : 40

une première portion (W2') agencée en parallèle, à la fois électriquement et physiquement, par rapport au premier enroulement (W1) et ayant un pas correspondant audit premier pas (p1), de sorte qu'il y ait une bobine du deuxième enroulement (W2) entre deux bobines successives du premier enroulement (W1) ; 45
 une deuxième portion (W2'') agencée électriquement en série par rapport à la première portion (W2') et physiquement en série par rapport au premier enroulement (W1), dans lequel ladite deuxième portion (W2'') a un deuxième pas (p2) 50
 qui est plus court que le premier pas (p1). 55

Fig.1

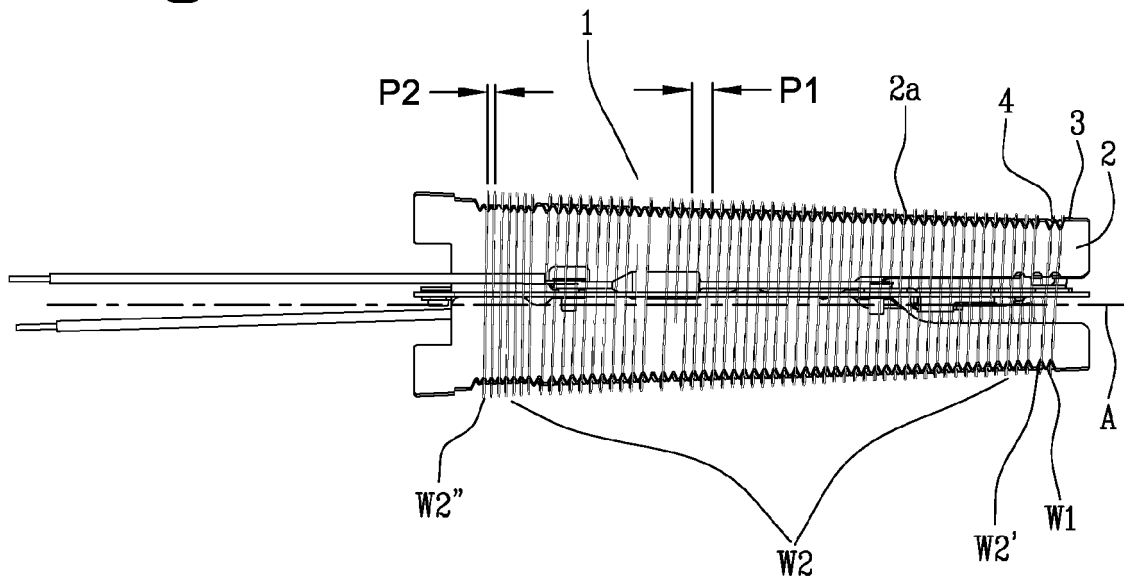


Fig.2

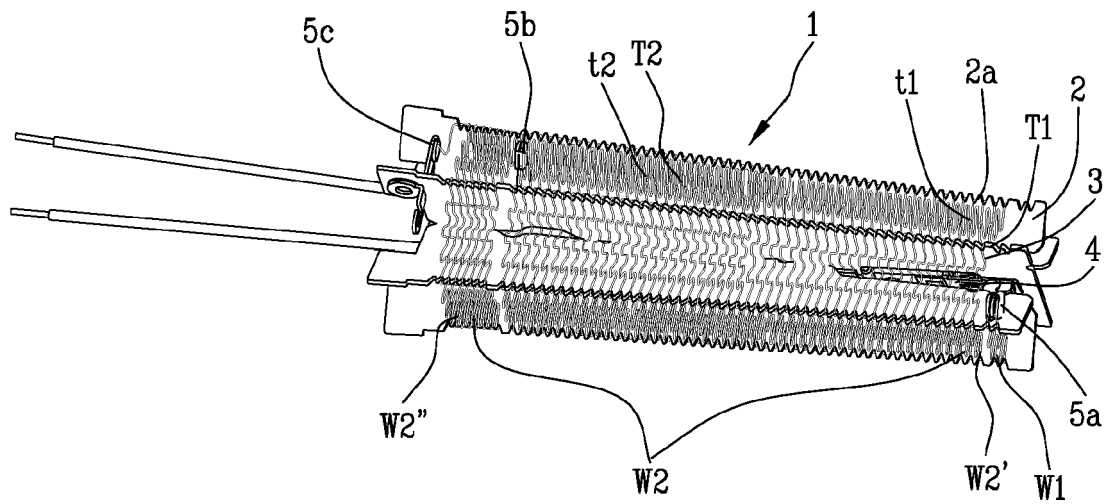


Fig.3

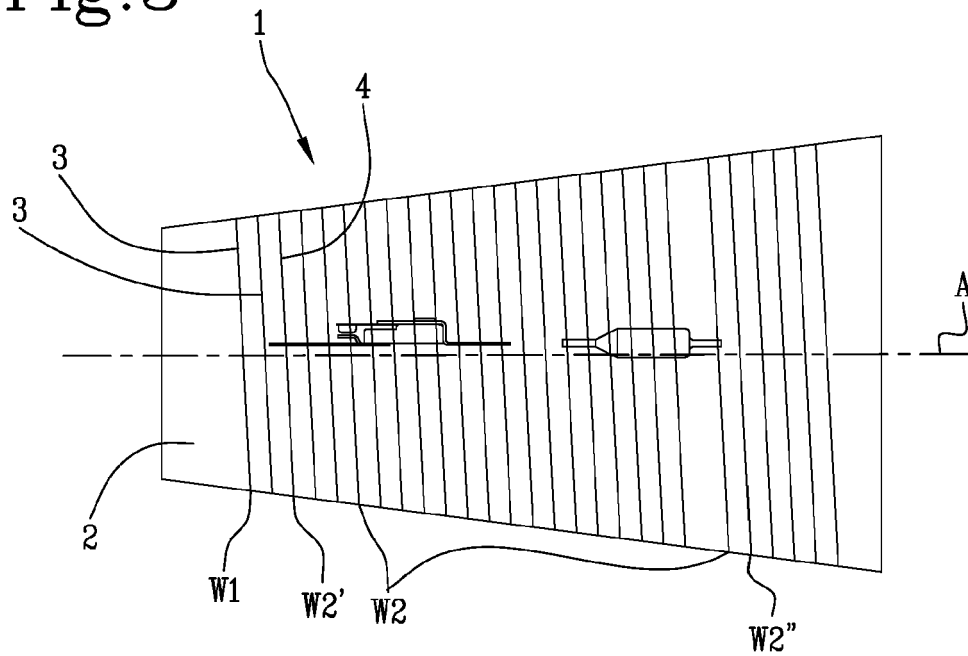


Fig.4

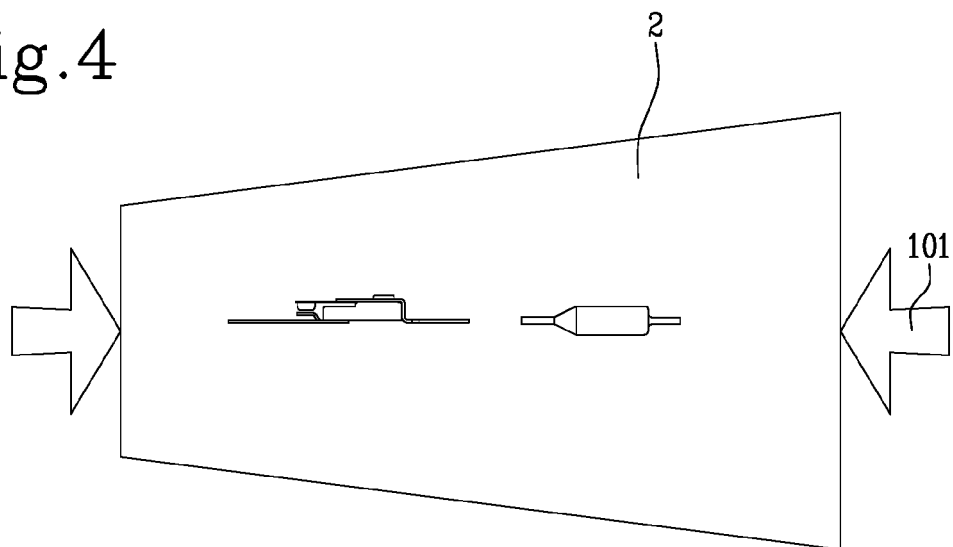


Fig.5

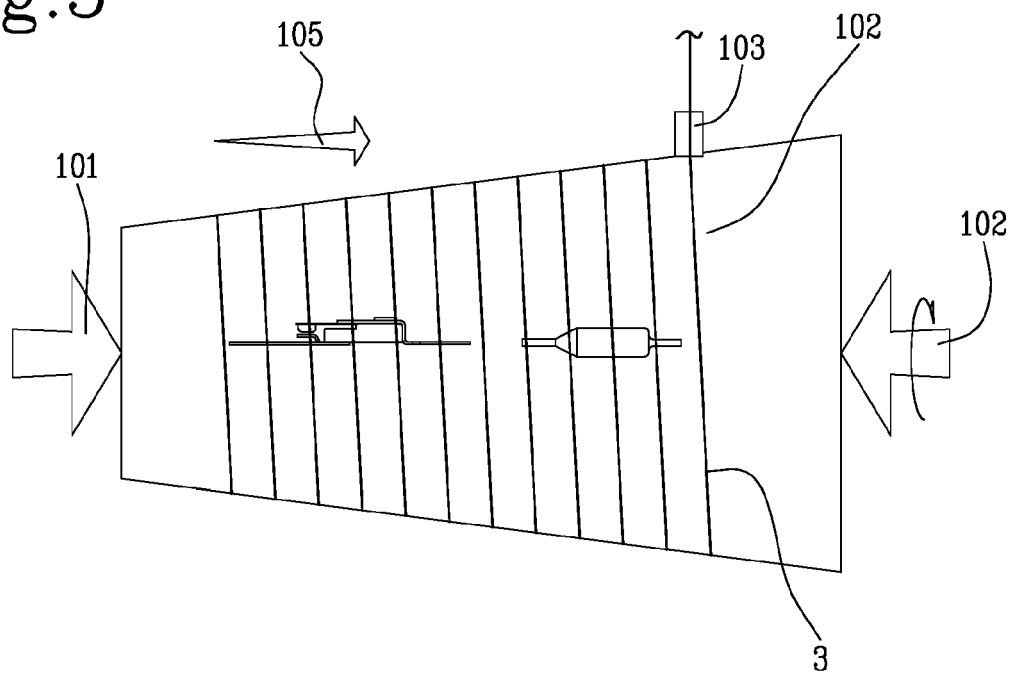


Fig.6

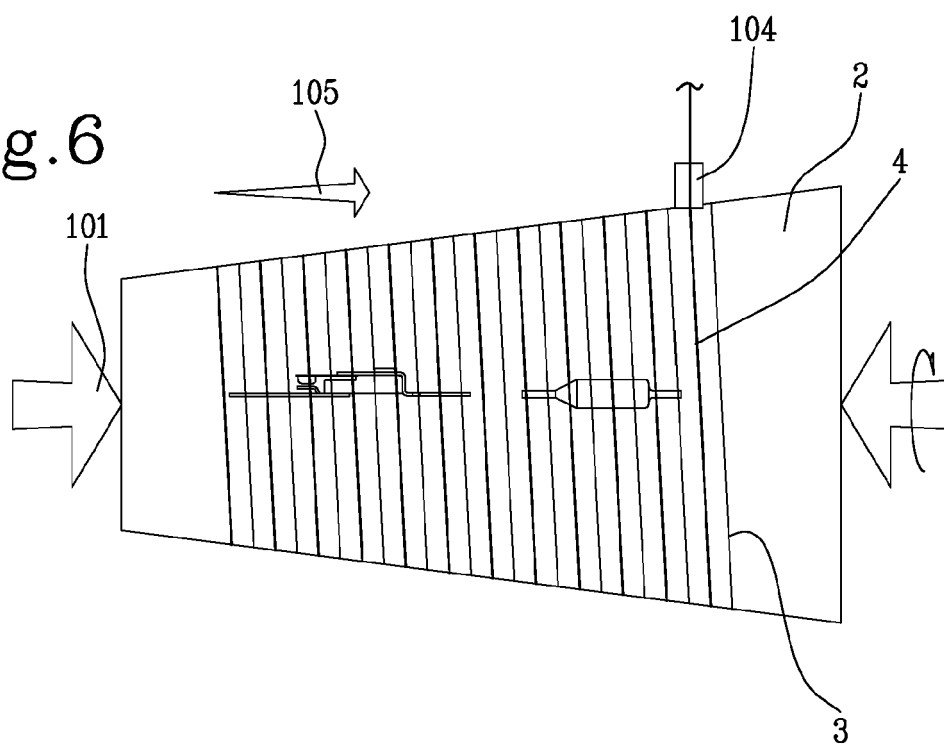
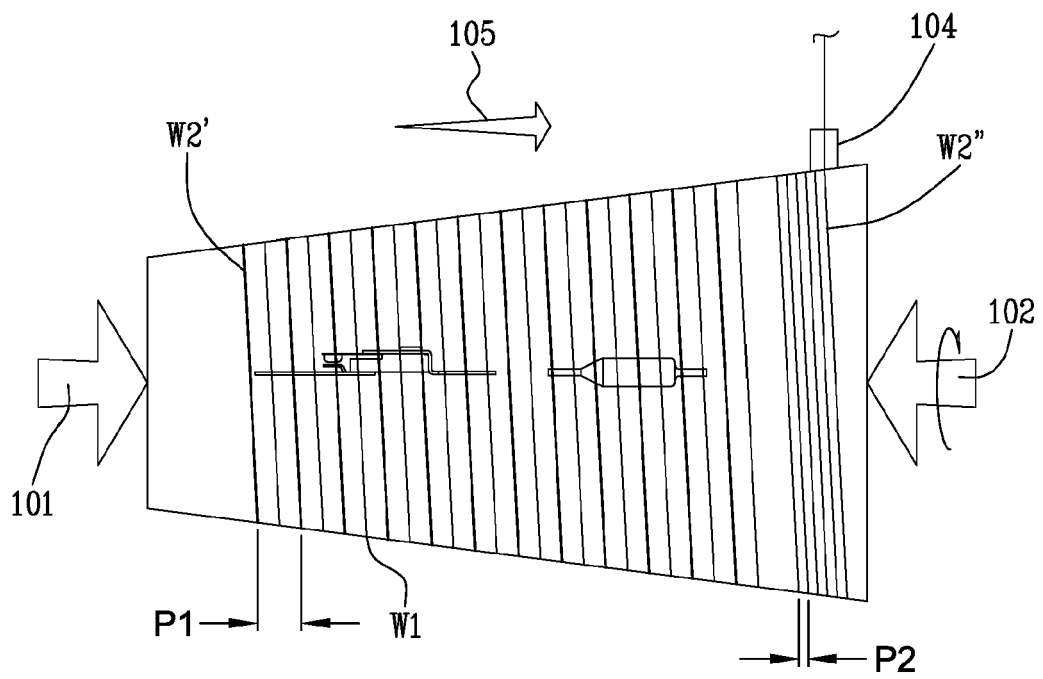


Fig.7



REFERENCES CITED IN THE DESCRIPTION

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