Description

Title of Invention: STATIC DISCHARGE GROUNDER

Technical field

[1] The present invention relates generally to electrostatic discharge field, and most specifically to a static discharge grounder.

Background of invention

[2] There are various prior arts that describe the applications and uses of many special moving or stationary grounding devices to ground static charge or static electricity to-date.

[3] US Patent 2125378 describes a grounding device that attaches to the metallic portion of a vehicle to drain any accumulated static charge from the vehicle to the ground. US Patent No. 6327131 B1 describes a transportation apparatus which includes an electrically conductive cart, an electrically conductive pad coupled to the cart, and a fastening device couple the pad to the cable. US Patent 6357767 describes a grounding device that attaches to the axle of a wheel to drain away any accumulated static charge from the moving apparatus to the ground.

[4] The grounding of carts, trolleys, chairs and other moving or non-moving objects are conventionally achieved by the use of static dissipative or conductive castors, wheels or rollers in a typical electrostatic protected area (EPA) in an electrostatic sensitive manufacturing environment. However, the use of electrostatic groundable castors, wheels or rollers possess some disadvantages in reality. The need to affix at least two or more units of such grounding devices to effectively ground each moving cart, trolley or chair due to the unevenness of most floors in real-life production site environment results in that the cost factor becomes commercially unattractive in a typically mass production environment. The accumulation of dirt or/and dust particle contaminants at the floor-contacting surface of the grounding devices directly causes changes to the electrical property thus affecting the integrity of the electrical grounding resistance making the monitoring and control of a static control program a difficult and challenging task.

[5] All these shortcomings highlighted above making the management and control of electrostatic charge more difficult especially in a large scale manufacturing environment in a typical electrostatic-sensitive component manufacturing industry. Therefore further research and development is needed to look for alternative means to invent a solution not only cheap and simple to make, but it should also be lasting and durable to achieve a dust-resistance grounding performance.

Summary of Invention

[6] The primary objective of this invention is to provide a static discharge grounder

which is not only cheap and simple to make, but should also be lasting and durable.

[7] The static discharge grounder according to present invention comprises a block with at least two punch-through holes on its top and bottom surfaces, a conductive elastic-thread threading through the at least two punch-through holes from one punch-through hole to another punch-through hole, forming an arch protruded at least on the bottom surface of the block thereby acting as a soft surface medium for contacting with a static dissipative or conductive flooring.

[8] Optionally, the block comprises a plurality of punch-through holes on its top and bottom surfaces, wherein, the conductive elastic-thread threads through the plurality of punch-through holes from one punch-through hole to another punch-through hole, forming arches protruded at least on the top surface and the bottom surface of the block and spreads out horizontally on both the top surface and the bottom surface in a circular pattern.

[9] Optionally, one central punch-through hole is at the barycenter of the block and the other holes are spread equidistantly on a circular pattern surrounding the barycenter, wherein, the conductive elastic-thread threads through the central punch-through hole with two ends and each hole has the conductive elastic-thread to thread through both from the top surface to the bottom surface and from the bottom surface to the top surface.

[10] Optionally, the conductive elastic-thread forms a continuing ring in round, oval, square, rectangle, hexagon or irregular shape on the top surface, the bottom surface or both surfaces of the block.

[11] Optionally, the conductive elastic-thread comprises at least a first conductive elastic-thread and a second conductive elastic-thread electrically insulated from each other, and the plurality of punch-through holes comprise at least a first group of punch-through holes and a second group of punch-through holes, the first conductive elastic-thread threads through the first group of punch-through holes from one punch-through hole to another punch-through hole, and the second conductive elastic-thread threads through the second group of punch-through holes from one punch-through hole to another punch-through hole.

[12] Optionally, the block is a metallic block, the plurality of punch-through holes is inserted with an insulation structure consisting of a round plastic plate with protruded cylindrical spikes.

[13] Optionally, the conductive elastic-thread is affixed with numerous coiled tubings to allow a freer rotation movement, when sliding on the floor.

[14] Optionally, the conductive elastic-thread comprises a metallic coiled wire, and the metallic coiled wire is made from 0.1mm to 1mm thick metallic wire with the coiled diameter ranged from 2 mm to 10 mm.

[15] Optionally, the metallic coiled wire is provided with a hook on one end and an enclosed ring or buckle on the other end for attaching the static discharge grounder to apparatus to be grounded.

[16] Optionally, the block is a circular metal block having flat top and bottom surfaces with a diameter in a range of 20mm to 200mm, and having a height in a range of 3mm to 50mm.

[17] Optionally, the block is a shoe of which the conductive elastic-thread is attached to its bottom surface.

[18] The arch formed by threading the holes from one hole to another described above is unique. In this way, the present application provides a technical advantage by delivering a soft surface contact through the use of conductive elastic-thread threading through these holes. Therefore, the present application is simple and low cost. There is no ball bearing, no screw, no bolt & nut, no adhesive and no rivet is required.

Brief Description of the Drawings

[19] So as to further explain the invention, an exemplary embodiment of the present invention will be described with reference to the below drawings, wherein:

[20] Fig. 1A is a diagram of the first embodiment of the static discharge grounder according to the present invention;

[21] Fig. 1B is a diagram of the second embodiment of the static discharge grounder according to the present invention;

[22] Fig. 2 is a diagram of the third embodiment of the static discharge grounder according to the present invention;

[23] Fig. 3 is a diagram showing the conductive elastic-thread threading through two punch-through holes;

[24] Fig. 4 is a diagram of the fourth embodiment of the static discharge grounder according to the present invention;

[25] Fig. 5 is a diagram of the fifth embodiment of the static discharge grounder according to the present invention;

[26] Fig. 6 is a diagram showing the punch-through holes of the fifth embodiment of the static discharge grounder according to the present invention;

[27] Fig. 7 is a diagram showing the usage of the static discharge grounder according to the present invention.

Detailed Description of the Preferred Embodiments

[28] These and other advantage, aspect and novel features of the present invention, as well as details of an illustrated embodiment thereof will be more fully understood from the following description and drawings, while various embodiments of the present invention are presented by way of examples only, not limitation. In the following

figures, the arrowhead refers to the direction of the air.

[29] Fig. 1A is a diagram of the first embodiment of the static discharge grounder according to the present invention. Referring Fig.1A, the static discharge grounder comprises a circular block 11 with two punch-through holes 12 on its top and bottom surfaces. A conductive elastic-thread 13 threads through the two punch-through holes 12 from one punch-through hole to another punch-through hole, forming an arch 14 protruded on the bottom surface of the circular block 11 thereby acting as a soft surface medium for contacting with a static dissipative or conductive flooring. The two ends of the conductive elastic-thread 13 are affixed to an object to be grounded. As shown in Fig.1A the conductive elastic-thread 13 forms a continuing ring in rectangle shape on the top surface and the bottom surface of the block. One skilled in the art should know that there may be more punch-through holes 12 on the top and bottom surfaces of the circular block 11, such that the conductive elastic-thread 13 forms a continuing ring in round, oval, square, hexagon or irregular shape on the top surface and the bottom surface of the circular block 11. In other embodiments of present invention, two ends of the conductive elastic-thread 13 each threads through one punch-through holes 12, and then ties together, such that just one arch is formed on the bottom surface of the block 11. One skilled in the art also should know that the circular block 11 can be in different shapes such as round, oval, square, rectangle, hexagon or irregular shape.

[30] In a preferable embodiment, the conductive elastic-thread 13 is a metallic coiled wire made from 0.1mm to 1mm thick metallic wire with the coiled diameter ranged from 2 mm to 10 mm. In another embodiment, the metallic coiled wire is a combination of various sizes and shapes of wire thickness and coil diameter in one or more pieces. In another preferable embodiment, the circular block 11 is a circular metal block having flat top and bottom surfaces with a diameter in a range of 20mm to 200mm, and having a height in a range of 3mm to 50mm. In other embodiment, the size of the circular metal block can be of any dimension as long as within the range of 20mm to 200mm flat surface diameter and 3mm to 50mm height.

[31] The arch formed by threading the holes from one hole to another described above is unique. In this way, the present application provides a technical advantage by delivering a soft surface contact through the use of conductive elastic-thread threading through these holes. Therefore, the present application is simple and low cost. There is no ball bearing, no screw, no bolt & nut, no adhesive and no rivet is required.

[32] It is well known in the trade that a soft surface contact is better and more reliable than a hard surface contact in achieving a more consistent electrical contact integrity due to imperfect flatness of most static dissipative or conductive flooring in real-life. This is especially important to those common static dissipative or conductive flooring

with popular “conductive vein” type. Surprisingly, the grounding technique using conductive elastic-thread, especially metallic coiled wire disclosed herewith not only soft, durable and lasting, it overcome the dust deposit or dust accumulation at the contacting point of the coiled wire (between coiled wire and floor) where it is resting on the floor compared to that of the current commercially available static dissipative or conductive castors, wheels or rollers.

[33] This unique design provides a workable solution to the continuous cleaning of the tip portion of surface-contacting coil wire to ensure that no foreign material is "blocking" the electrical path between the grounding device and the static dissipative or conductive flooring.

[34] The dust-free or soil-free property of the static discharge grounder according to the present invention is very important to ensure good electrical contact integrity all the times without affecting the body to ground resistance in a well managed electrostatic protected area (EPA). When the circular metal block is placed on an ESD floor, the coiled wire at the bottom surface is exerted with a downwards force by the gravitational force to electrically connect itself to an ESD floor. Due to the uniqueness of the coiled wire metal block design, the resultant circular metal block can move freely in all directions. In a typical hot-weld static dissipative or conductive PVC flooring, the invention overcomes any protruded uneven floor joints or cracked lines due to aging of the floors.

[35] Fig. 1B is a diagram of the second embodiment of the static discharge grounder according to the present invention. Referring Fig.1B, the static discharge grounder comprises a circular block 11 with three punch-through holes 12 on its top and bottom surfaces. A conductive elastic-thread 13 threads through the three punch-through holes 12 from one punch-through hole to another punch-through hole, forming two arches 14 protruded on the bottom surface of the circular block 11 for contacting with a static dissipative or conductive flooring and two arches 14 protruded on the top surface of the circular block 11. The two ends of the conductive elastic-thread 13 are affixed to an object to be grounded. As shown in Fig.1B the conductive elastic-thread 13 forms an angle shape on the top surface and the bottom surface of the block.

[36] Fig. 2 is a diagram of the third embodiment of the static discharge grounder according to the present invention. Referring Fig2, the static discharge grounder comprises a circular block 21 with six punch-through holes 22 on its top and bottom surfaces 31 and 30. A conductive elastic-thread 23 threads through the six punch-through holes 12 from one punch-through hole to another punch-through hole, forming six arches 24 protruded on the bottom surface 30 of the circular block 11 for contacting with a static dissipative or conductive flooring and five arches 28 protruded on the top surface 31 of the circular block 11. The six arches 24 and five arches 28 separately

spread out horizontally on both the bottom surface 30 and the top surface 31 in a circular pattern. The two ends of the conductive elastic-thread 23 threads through the punch-through hole at the middle of the circular block 21 from the bottom surface 30 to the top surface 31 and form an attachment device. The conductive elastic-thread 23 is provided with a hook 25 on one end and an enclosed ring or buckle 26 on the other end for forming an attachment device so as to affix the static discharge grounder to apparatus to be grounded.

[37] In other embodiment, the static discharge grounder comprises a circular block 21 with three, four, five or seven or more punch-through holes 22 on its top and bottom surfaces 31 and 30. One skilled in the art also should know that the circular block 21 can be in different shapes such as round, oval, square, rectangle, hexagon or irregular shape. In such embodiment, the block has one central punch-through hole at the barycenter of the block and other punch-through holes equidistantly or non-equidistantly on a circular pattern surrounding the barycenter. Wherein, the conductive elastic-thread threads 23 through the central punch-through hole with two ends, and each other punch-through holes has the conductive elastic-thread 23 to thread through both from the top surface to the bottom surface and from the bottom surface to the top surface.

[38] In a preferable embodiment, the conductive elastic-thread 13 is a metallic coiled wire made from 0.1mm to 1mm thick metallic wire with the coiled diameter ranged from 2 mm to 10 mm. In another embodiment, the metallic coiled wire is a combination of various sizes and shapes of wire thickness and coil diameter in one or more pieces. In another preferable embodiment, the circular block 11 is a circular metal block having flat top and bottom surfaces with a diameter in a range of 20mm to 200mm, and having a height in a range of 3mm to 50mm. In other embodiment, the size of the circular metal block can be of any dimension as long as within the range of 20mm to 200mm flat surface diameter and 3mm to 50mm height.

[39] The arches formed by threading the holes from one hole to another described above are unique. In this way, the present application provides a technical advantage by delivering a soft surface contact through the use of conductive elastic-thread threading through these holes. Therefore, the present application is simple and low cost. There is no ball bearing, no screw, no bolt & nut, no adhesive and no rivet is required.

[40] Fig. 3 is a diagram showing the conductive elastic-thread threading through two punch-through holes. As shown in Fig.3, the block can be a holder 32 on which the metallic coiled wire 33 is affixed to. The holder 32 can be a weight by itself, or any object that can hold the metallic coiled wire 33 to creates a vertical downwards force to aid the metallic coiled wire 33 to electrically connect to the ESD floor to drain away any static charge that may reside on an object like chair in a typical ESD control work

environment in the electronics. As shown in Fig.3, the punch-through holes 34 has the metallic coiled wire 33 to thread through both from the top surface to the bottom surface and from the bottom surface to the top surface so as to form arches on the top surface and the bottom surface.

[41] Similarly, the holder 32 can be a shoe of which the metallic coiled wire 33 is mechanically designed to attached onto the bottom surface of the shoe or vice versa. The weight can be the weight of a person (diagram not shown) etc.

[42] The metallic coiled wire 33 is made from 0.1mm to 1mm thick metallic wire with the coiled diameter ranged from 2 mm to 10 mm. In another embodiment, the metallic coiled wire 33 is a combination of various sizes and shapes of wire thickness and coil diameter in one or more pieces.

[43] The arches formed by threading the holes from one hole to another described above are unique. In this way, the present application provides a technical advantage by delivering a soft surface contact through the use of conductive elastic-thread threading through these holes. Therefore, the present application is simple and low cost. There is no ball bearing, no screw, no bolt & nut, no adhesive and no rivet is required.

[44] Fig. 4 is a diagram of the fourth embodiment of the static discharge grounder according to the present invention. As shown in Fig.4, the conductive elastic-thread 40 is affixed with numerous coiled wire tubings 41 to allow a freer rotation movement, when sliding on the floor to reduce the wear and tear of the conductive elastic-thread 40 contacting with the floor. The other structure of the static discharge grounder can be constructed according to the embodiments discussed above.

[45] This arch formed by threading the holes from one hole to another of the invention is unique as it can achieve the following advantages, such as it can move freely in all direction, can move smoothly over floor with uneven floor joints or cracked lines, will not cause any flaking or shedding of unwanted contaminant in cleanroom application, is very simple to produce without any expensive tooling, and requires low cost and little or no maintenance.

[46] This arch formed by threading the holes from one hole to another of the invention formed in various structure and configurations of metallic coiled wire exerted with a downwards force achieves an unique grounding solution between an object and the ground.

[47] Fig.5-6 show the fifth embodiment of the static discharge grounder according to the present invention. Referring Fig.5-6, the static discharge grounder comprises a circular block 11 with 8 punch-through holes on its top and bottom surfaces. The 8 punch-through holes are divided into two groups. The first group of punch-through holes comprises 4 punch-through holes 54 close to the center of the circular block 11. The second group of punch-through holes comprises 4 punch-through holes 53 close to the

outer periphery of the circular block 11. The distribution of the conductive elastic-thread can be arranged in two individually separated conductive coiled springs 51 and 52 electrically insulated from each other. The conductive coiled spring 51 threads through the 4 punch-through holes 53 from one punch-through hole to another punch-through hole so as to form four arches 55 protruded at least on the top surface and the bottom surface of the block and spreads out horizontally on both the top surface and the bottom surface in an outer quadrangle pattern. The conductive coiled spring 52 threads through the 4 punch-through holes 54 from one punch-through hole to another punch-through hole so as to form four arches 56 protruded at least on the top surface and the bottom surface of the block and spreads out horizontally on both the top surface and the bottom surface in an inner quadrangle pattern.

[48] As shown in Fig.6, the circular block 11 is a metallic circular block having the wall surface of the punch-through holes 53-54 and the bottom surface be made insulative by the insertion of an insulation structure 531 or 541 consists of a round plastic plate with protruded cylindrical spikes. In other embodiment, the circular block 11 is a metallic circular block having the wall surface of the punch-through holes 53-54 coated with insulation materials. Thereafter, the two separated conductive coiled springs 51 and 52 are electrically insulated from each other.

[49] Fig. 7 is a diagram showing the usage of the static discharge grounder according to the present invention. As shown in Fig.7, the two terminals of the conductive coiled spring in the static discharge grounder 1 according to present application is connected to an electrical closed-loop circuit 2 with an electronic sensor S installed at any point along the closed-loop electrical path of a person sitting on a chair to detect any open or closed circuit of the electrical path to ensure the grounding integrity of the static dissipative or conductive floor through the closed-loop system.

[50] The current invention achieves a simpler and more unique grounding solution over the current conventional practice in the industry. In summary, a novel and unique grounding device which is simple to make, low cost to produce and durable in design, while effectively dissipating electrostatic charge to ground even with the presence of dirt and particles is hereby been researched and disclosed.

[51] The foregoing description is just the preferred embodiment of the invention. It is not intended to exhaustive or to limit the invention. Any modifications, variations, and amelioration without departing from the spirit and scope of the present invention should be included in the scope of the prevent invention.

Claims

[Claim 1] 1. A static discharge grounder comprising a block with at least two punch-through holes on its top and bottom surfaces, a conductive elastic-thread threading through the at least two punch-through holes from one punch-through hole to another punch-through hole, forming an arch protruded at least on the bottom surface of the block thereby acting as a soft surface medium for contacting with a static dissipative or conductive flooring.

[Claim 2] 2. The static discharge grounder according to claim 1, wherein the block comprises a plurality of punch-through holes on its top and bottom surfaces, wherein, the conductive elastic-thread threads through the plurality of punch-through holes from one punch-through hole to another punch-through hole, forming arches protruded at least on the top surface and the bottom surface of the block and spreads out horizontally on both the top surface and the bottom surface in a circular pattern.

[Claim 3] 3. The static discharge grounder according to claim 2, wherein one central punch-through hole is at the barycenter of the block and the other holes are spread equidistantly on a circular pattern surrounding the barycenter, wherein, the conductive elastic-thread threads through the central punch-through hole with two ends and each hole has the conductive elastic-thread to thread through both from the top surface to the bottom surface and from the bottom surface to the top surface.

[Claim 4] 4. The static discharge grounder according to claim 3, wherein the conductive elastic-thread forms a continuing ring in round, oval, square, rectangle, hexagon or irregular shape on the top surface, the bottom surface or both surfaces of the block.

[Claim 5] 5. The static discharge grounder according to any one of claims 2-4, wherein the conductive elastic-thread comprises at least a first conductive elastic-thread and a second conductive elastic-thread electrically insulated from each other, and the plurality of punch-through holes comprise at least a first group of punch-through holes and a second group of punch-through holes, the first conductive elastic-thread threads through the first group of punch-through holes from one punch-through hole to another punch-through hole, and the second conductive elastic-thread threads through the second group of punch-through holes from one punch-through hole to another punch-through hole.

[Claim 6] 6. The static discharge grounder according to claim 5, wherein the block is a metallic block, the plurality of punch-through holes is inserted with an insulation structure consisting of a round plastic plate with protruded cylindrical spikes.

[Claim 7] 7. The static discharge grounder according to claim 1, wherein the conductive elastic-thread is affixed with numerous coiled tubings to allow a freer rotation movement, when sliding on the floor.

[Claim 8] 8. The static discharge grounder according to claim 1, wherein the conductive elastic-thread comprises a metallic coiled wire, and the metallic coiled wire is made from 0.1mm to 1mm thick metallic wire with the coiled diameter ranged from 2 mm to 10 mm.

[Claim 9] 9. The static discharge grounder according to claim 8, wherein the metallic coiled wire is provided with a hook on one end and an enclosed ring or buckle on the other end for attaching the static discharge grounder to apparatus to be grounded.

[Claim 10] 10. The static discharge grounder according to claim 1, wherein the block is a circular metal block having flat top and bottom surfaces with a diameter in a range of 20mm to 200mm, and having a height in a range of 3mm to 50mm.

[Claim 11] 11. The static discharge grounder according to claim 1, wherein the block is a shoe of which the conductive elastic-thread is attached to its bottom surface.

Abstract

A static discharge grounder is disclosed. The static discharge grounder comprises a block with at least two punch-through holes on its top and bottom surfaces, a conductive elastic-thread threading through the at least two punch-through holes from one punch-through hole to another punch-through hole, forming an arch protruded at least on the bottom surface of the block thereby acting as a soft surface medium for contacting with a static dissipative or conductive flooring. The present application is simple and low cost. There is no ball bearing, no screw, no bolt & nut, no adhesive and no rivet is required.

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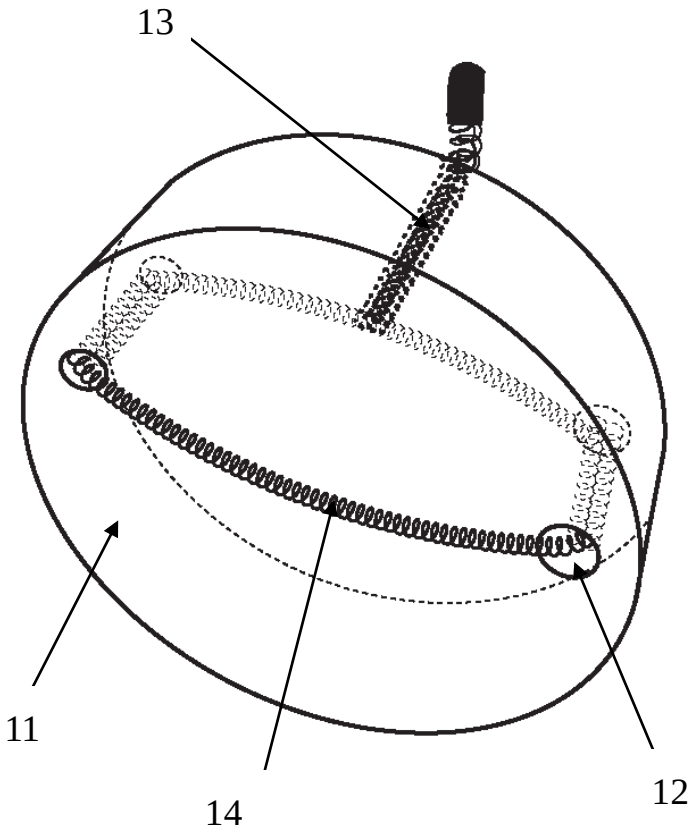

Fig.1A

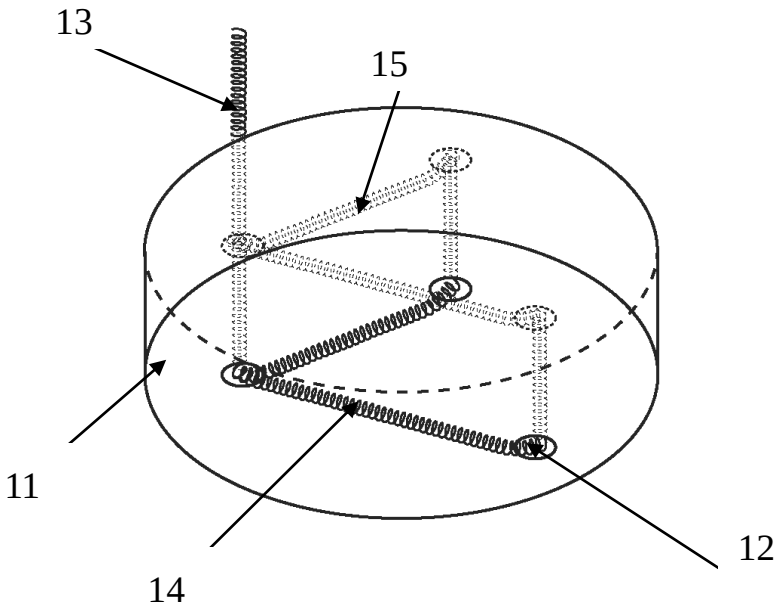

Fig.1B

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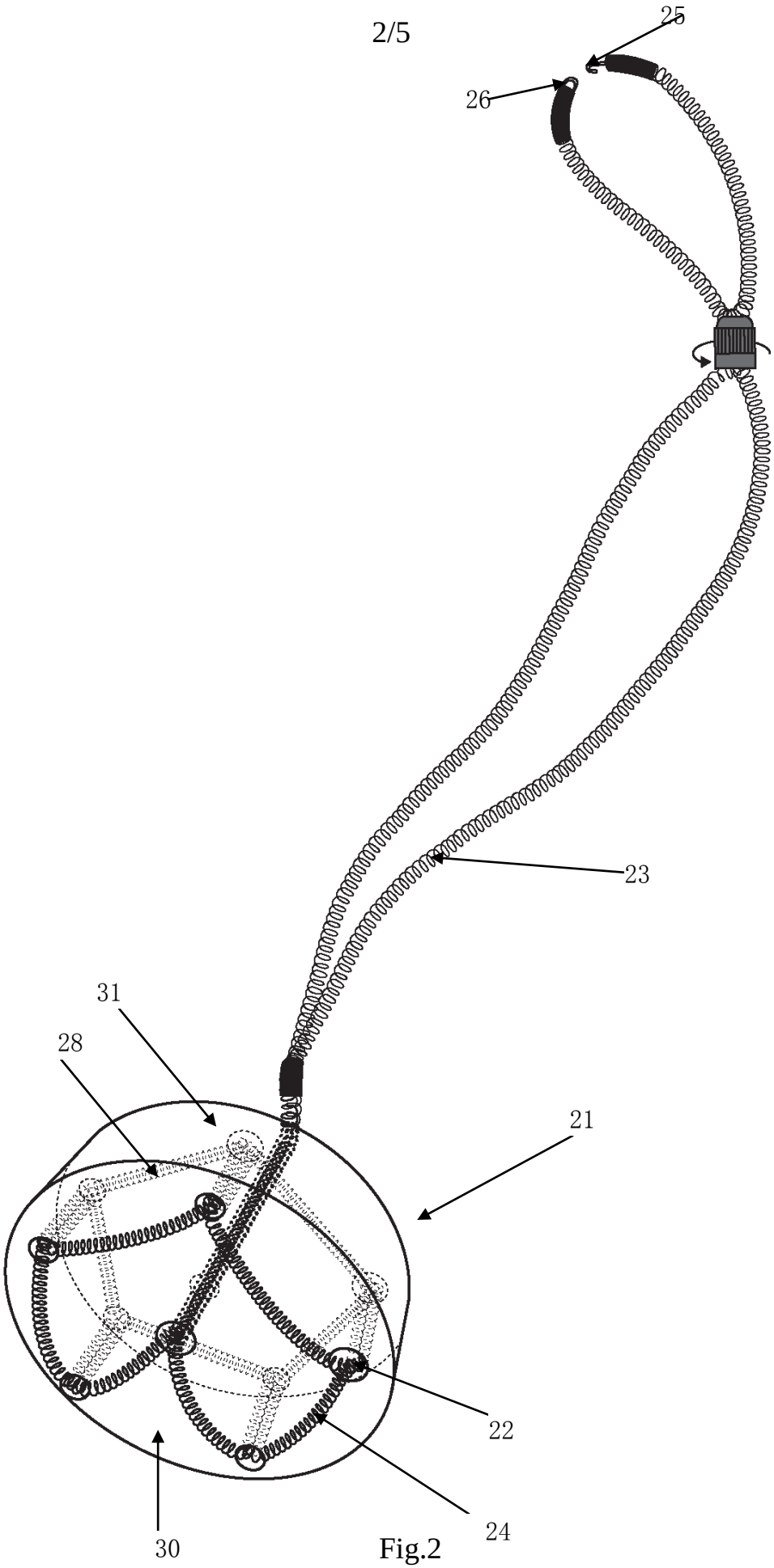

Fig.2

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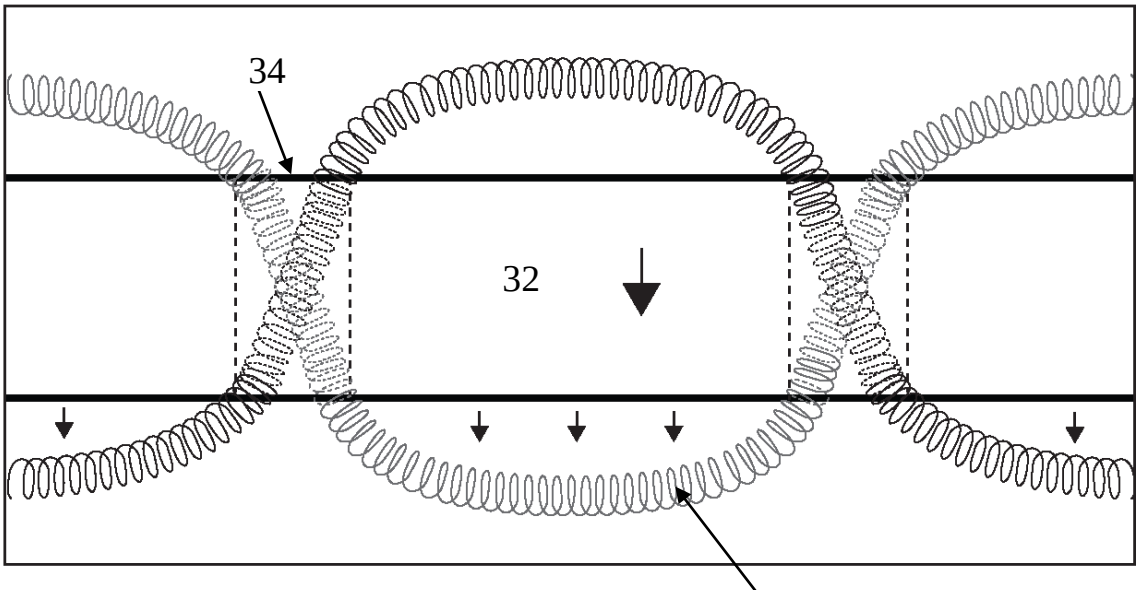

Fig.3

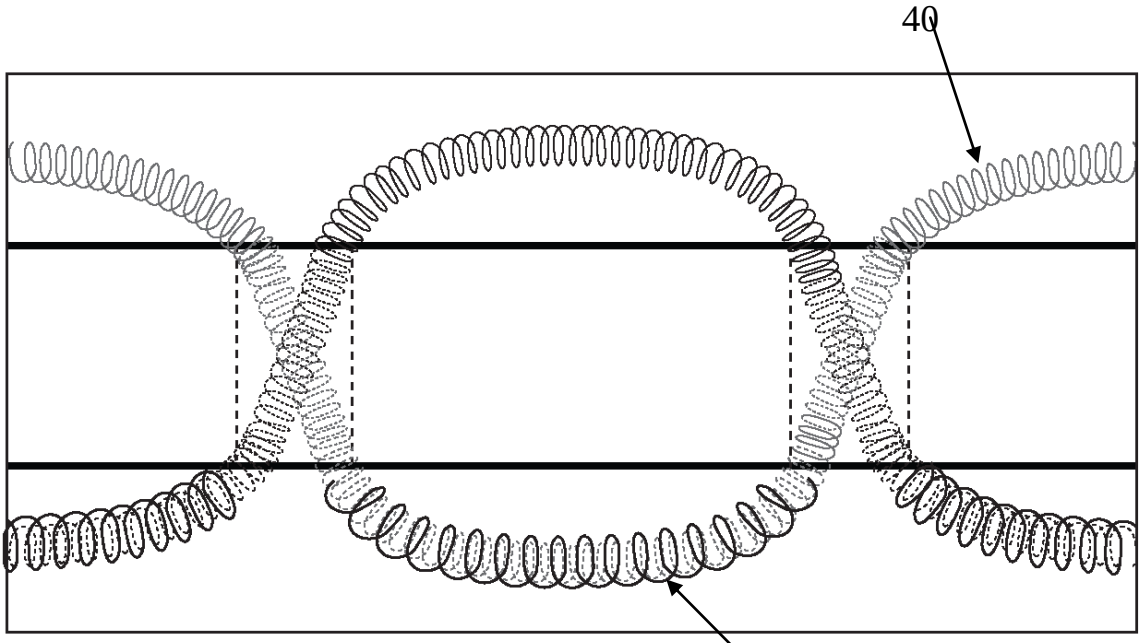

Fig.4

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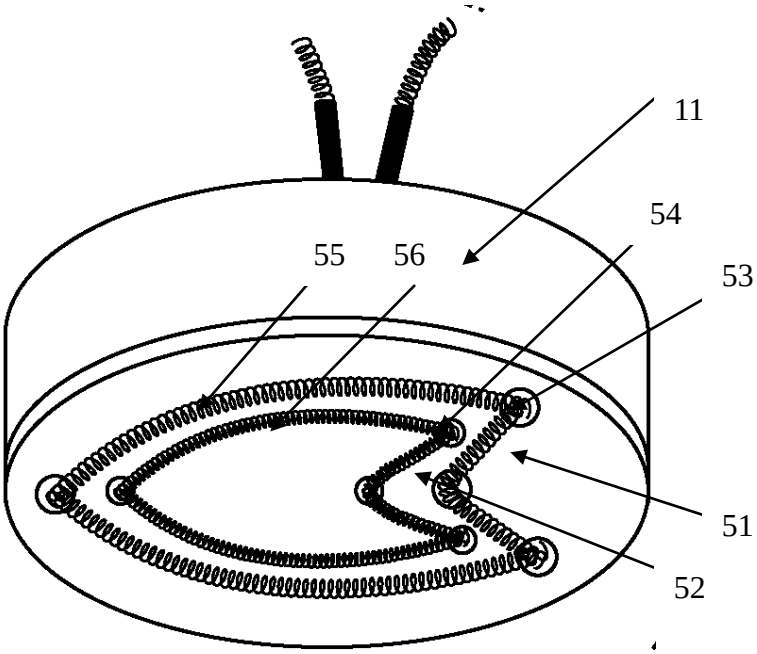

Fig.5

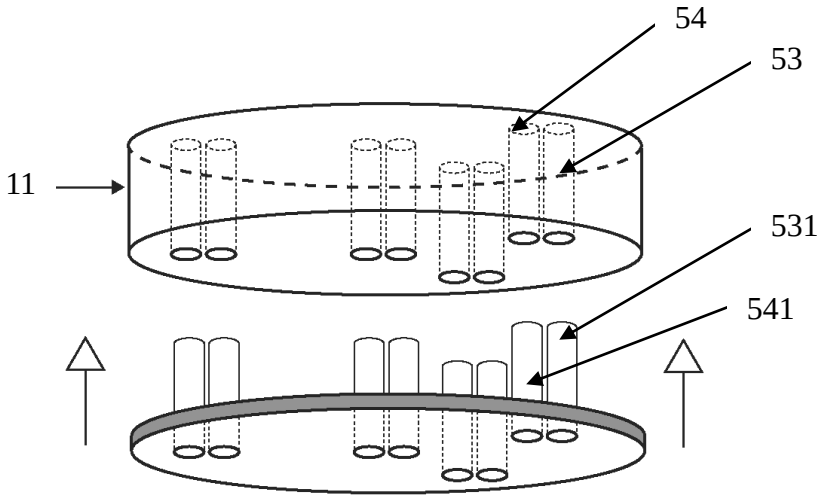

Fig.6

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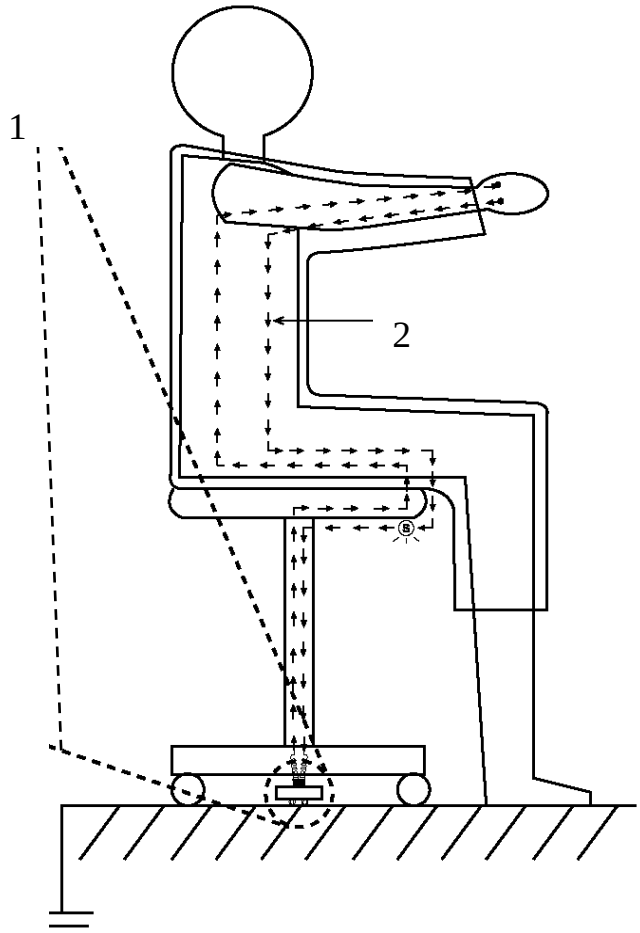

Fig.7