Description

Title of Invention: CHAIR BAND GROUNDER

Technical field

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

Background of invention

[2] Chairs are a common item used in a manufacturing facility. The movement of human on a chair can cause static electricity to discharge and damage electronics components. An electrostatic discharge chair can help in eliminating static electricity to protect electrostatic discharge sensitive devices.

[3] A typical electrostatic discharge chair consists of an electrostatic discharge seating, electrically connected to a metal swivel post, extending downwards through the main metal swivel post to a plurality of radially spread out metallic legs. Each leg is fixed with a conductive or static dissipative swivel castor to allow static charge dissipative to ground and allow free movement of the chair on the floor.

[4] However, the cost of a properly designed electrostatic discharge chair can be prohibitive when considering a large scale implementation in a typical labour intensive electronics assembly operation. An alternative to a costly large scale implementation of electrostatic discharge chairs is the use of detachable electrostatic discharge chair covers.

[5] U.S. Pat. 2011/0267735 A1 describes a conductive or static dissipative chair cover, a unique flexible conductive ground loop and grounding means to be used on a typical swivel chair. However, ESD chair cover is not suitable for use in a critical environment cleanroom due to accumulation of dust and particles that can easily trapped at the recesses or gaps of the folded edges of the ESD chair cover. Over time, the dust and particles will eventually release into the air due to the air turbulence from the purging action of the air around the edges of the ESD chair cover whenever a worker sits thereby contaminate the cleanroom air in a cleanroom critical manufacturing environment in the electronics, pharmaceutical, aerospace and high technology industry.

[6] Therefore further investigation and research is needed to develop a better method or product that will overcome the current shortcomings described above.

Summary of Invention

[7] In present technical field, most people perceive that a pad or cover to cover the full seat's surface is needed to effectively drain static charge from a human body to the chair and subsequently to ground.

[8] Surprisingly, this is not the case. The applicant surprisingly discovers and confirms that it is the electrical resistance of the body to ground that determines the effec-

tiveness, not how big is the chair seat coverage.

[9] Based on such unexpected discovery, the primary objective of this invention is to provide a chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm to 150mm, a first conductive attachment element fastened to one end of the static dissipative or conductive band and attached onto a chair, and a second conductive attachment element with one end electrically connecting itself to a centre rotating shaft of the chair and the other end fastend to the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground in a clean, neat and sleek manner without the usual accumulation of dust and particles in a standard static dissipative or conductive chair cover to achieve unusual technical improvement.

[10] Optionally, the first conductive attachment element is a U-shape hook-like structure affixed to the one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith and hooked onto an edge of a chair seat of the chair at a region just below back rest of the chair.

[11] Optionally, the second conductive attachment element comprises a buckle that is hooked by a stretchable metallic coiled spring with a conductive hook underneath the chair seat.

[12] Optionally, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[13] Optionally, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

[14] Optionally, the static dissipative or conductive band is made of static dissipative or conductive plastic, metal, carbonized or non-carbonized material, or a combination of two or more of the aforesaid materials.

[15] Optionally, the static dissipative or conductive band is opaque, translucent, transparent or a combination of them.

[16] Optionally, the first conductive attachment element comprises a chain ring affixed to the one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith; and a chain body encompassing a conductive shaft for a chair back rest of the chair, wherein, the chain body is provided with a clasp for fixing the chain body to the conductive shaft, wherein, the chain ring and the chain body are formed by a plurality of small rings hitched together.

[17] The secondary objective of this invention is to provide a chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm

to 150mm, a U-shape hook-like structure fastened to one end of the static dissipative or conductive band and hooked onto an edge of a chair seat at a region just below back rest of a chair, and a buckle that is hooked by a stretchable metallic coiled spring provided with a conductive hook underneath the chair seat for connecting itself to a centre rotating shaft of the chair, wherein, the buckle is fastened to the other end of the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground in a clean, neat and sleek manner without the usual accumulation of dust and particles in a standard static dissipative or conductive chair cover to achieve unusual technical improvement.

[18] Optionally, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[19] Optionally, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

[20] The third objective of this invention is to provide a chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm to 150mm, a chain attachment with a chain ring affixed to the one end of the static dissipative or conductive band and a chain body encompassing a conductive shaft for a chair back rest of the chair, and a buckle that is hooked by a stretchable metallic coiled spring provided with a conductive hook underneath the chair seat for connecting itself to a centre rotating shaft of the chair, wherein, the chain body is provided with a clasp for fixing the chain body to the conductive shaft, wherein, the chain ring and the chain body are formed by a plurality of small rings hitched together; the buckle is fastened to the other end of the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground in a clean, neat and sleek manner without the usual accumulation of dust and particles in a standard static dissipative or conductive chair cover to achieve unusual technical improvement. Optionally, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[21] Optionally, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

[22] As discussed above, the present application discloses a chair band grounder having a static dissipative or conductive band with at least a U-shape hook-like structure at one of the ends of the static dissipative or conductive band for a quick lock onto the chair seat securely to convert a normal chair to an ESD chair quickly and inexpensively.

[23] The use of the static dissipative or conductive band is unique compared to a static

dissipative or conductive chair cover. The present application is not only surprisingly simple, it also allows quick change of worn out band achieving extraordinary user friendly design with very low ESD chair maintenance cost while eliminating the problem of dust and particles accumulation just underneath the edge rim of the chair along the parameter of the chair cover in a stringent cleanroom work environment

[24] The chair band grounder of present application has fewer parts, less joints and less electrical contact parts compared to ESD chair cover in facilitating the drainage of static charge via a continuous electrical path from the body of a person to a metallic shaft, to the conductive castors and subsequent to a conductive or static dissipative floor with its time and labour saving, easy- to-install hook-on feature.

Brief Description of the Drawings

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

[26] Fig. 1 is a diagram of the chair band grounder according to a first embodiment of the present application;

[27] Fig. 2 is a diagram of the chair band grounder according to a second embodiment of the present application;

[28] Fig. 3 is a diagram of the chair band grounder according to a third embodiment of the present application;

[29] Fig.4 shows tables 1-3 including comparison test data of the magnitude of the body voltages versus various types of ESD chair seat surfaces collected.

Detailed Description of the Preferred Embodiments

[30] 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.

[31] Fig. 1 is a diagram of the chair band grounder according to a first embodiment of the present application. As shown in Fig.1, the chair band grounder consists of a static dissipative or conductive band 3, a first conductive attachment element 1 and a second conductive attachment element 2.

[32] The first conductive attachment element 1 is fastened to one end of the static dissipative or conductive band 3 through any conventional means by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, Velcro, adhesive means or a combination of two or more of the methods described herewith. The first conductive attachment element 1 is further attached onto a chair seat of a chair. In present embodiment, the first conductive attachment element 1 can be any attachment element which capable of electrically connecting one end of the static dissipative or conductive

band 3 and the chair seat, such as fastening element, adhesive element, and so on. The second conductive attachment element 2 is electrically connecting itself to a centre rotating shaft of the chair. Meanwhile the second conductive attachment element 2 is fastened to the other end of the static dissipative or conductive band 3 through any conventional means by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, Velcro, adhesive means or a combination of two or more of the methods described herewith. In such a way, a normal chair is converted to an ESD chair quickly and inexpensively, and static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground without accumulation of dust and particles.

[33] In present embodiment, the second conductive attachment element 2 can be any attachment element which is capable of electrically connecting itself to one end of the static dissipative or conductive band 3 and also connecting itself to the centre rotating shaft of the chair, such as fastening element, adhesive element, and so on.

[34] In present application, the static dissipative or conductive band 3 is a belt, a strip or any thin material that can be strapped over the chair seat surface to electrically connect the body of a person to the chair. The width of the static dissipative or conductive band 3 is in the range from 0.1mm to 150mm, more specifically from 25mm to 50mm. The static dissipative or conductive band 3 serves as a conductive medium to conduct any static charge that may reside on a person's body to the chair seat. The static charge will be drained to the ground when the chair seat is subsequently electrically connected to the floor and finally to the ground.

[35] In present application, the static dissipative or conductive band 3 is made of static dissipative or conductive plastic, metal, carbonized or non-carbonized material, or a combination of two or more of the aforesaid materials.

[36] In present application, the static dissipative or conductive band 3 is opaque, translucent, transparent or a combination of two or more of said features in a single belt to enhance cosmetic appearance and to achieve good commercial value.

[37] The application provides a grounding solution for a person while sitting on a chair without the use of an ESD chair cover in eliminating the dust accumulation just underneath the edge rim along the parameter of a typical conductive chair cover in a stringent cleanroom work environment in a typical high technology electronics production or manufacturing site.

[38] Fig. 2 is a diagram of the chair band grounder according to a second embodiment of the present application. As shown in Fig.2, the chair band grounder consists of a static dissipative or conductive band 3, a first conductive attachment element 1 and a second conductive attachment element 2. In present application, the first conductive attachment element 1 is a U-shape hook-like structure affixed to the one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on,

staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith. The U-shape hook-like structure is hooked onto an edge of the chair seat at a region just below back rest of the chair. The second conductive attachment element 2 comprises a buckle 21 and a stretchable metallic coiled spring 22 provided with a conductive hook 23 underneath the front portion of the chair seat. The buckle 21 is a metallic polygon-like structure with one side affixed to the one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, Velcro, adhesive means or a combination of two or more of methods described herewith. The conductive hook 23 hooks at one angle of the metallic polygon-like structure buckle 21. One skilled in the art knows that the buckle 21 can be any shape including triangular, square, round, hexagon etc.. The stretchable metallic coiled spring 22 is electrically linked with one end to the buckle and the other end to the main shaft located just below the centre of the chair seat. In such a way, a normal chair is converted to an ESD chair quickly and inexpensively, and static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground without accumulation of dust and particles.

[39] In present application, the U-shape hook-like structure 1 that hooks onto the edge-rim of the chair seat below the back-rest is a metal, plastic or a combination of plastic and metal hook. The buckle 21 also can be a metal or a combination of plastic and metal ring. The conductive hook 23 also can be a metal, plastic or a combination of plastic and metal hook.

[40] In present application, the static dissipative or conductive band 3 is a belt, a strip or any thin material that can be strapped over the chair seat surface to electrically connect the body of a person to the chair. The width of the static dissipative or conductive band 3 is in the range from 0.1mm to 150mm, more specifically from 25mm to 50mm. The static dissipative or conductive band 3 serves as a conductive medium to conduct any static charge that may reside on a person's body to the chair seat. The static charge will be drained to the ground when the chair seat is subsequently electrically connected to the floor and finally to the ground.

[41] In present application, the static dissipative or conductive band 3 is made of static dissipative or conductive plastic, metal, carbonized or non-carbonized material, or a combination of two or more of the aforesaid materials.

[42] In present application, the static dissipative or conductive band 3 is opaque, translucent, transparent or a combination of two or more of said features in a single belt to enhance cosmetic appearance and to achieve good commercial value.

[43] Optionally, a resistor is connected in series at any spot along any electrical path from the conductive hook 23 to the metallic shaft of the chair as shown in figure 2. The resistor acts as a safety device to limit the current flow to a safe limit in the event of an

accidental touch of a live wire by a person sitting on the chair.

[44] The present application achieve a uniquely simple static dissipative or conductive chair band design that is easily fasten onto the seat of a chair with less parts, less joints and less electrical contact problems compared to a static dissipative or conductive chair cover thus saving time and labour cost in installation with its easy-to-install hook-on feature to drain static charge via a continuous electrical path from the body of a person to a static dissipative or conductive belt, a metallic shaft, the conductive castors and subsequent to a conductive or static dissipative floor.

[45] The present application provides a grounding solution for a person while sitting on a chair without the use of an ESD chair cover in eliminating the dust accumulation just underneath the edge rim along the parameter of a typical conductive chair cover in a stringent cleanroom work environment in a typical high technology electronics production or manufacturing site.

[46] As we discussed above, most people perceive that a pad or cover to cover the full seat's surface is needed to effectively drain static charge from a human body to the chair and subsequently to ground.

[47] Surprisingly, this is not the case. Repeated tests discover and confirm that it is the electrical resistance of the body to ground that determines the effectiveness, not how big is the chair seat coverage.

[48] Fig. 3 is a diagram of the chair band grounder according to a third embodiment of the present application.

[49] As shown in Fig.3, the chair band grounder consists of a static dissipative or conductive band 3, a first conductive attachment element 4 and a second conductive attachment element 2. In present application, the second conductive attachment element 2, the static dissipative or conductive band 3 can be constructed according to Fig.2, and not described in detail.

[50] In present embodiment, the first conductive attachment element 1 can be a chain attachment 4. The chain attachment 4 comprises a chain ring 33 which is affixed to the one end of the static dissipative or conductive band 3 by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith. The chain ring is formed by a plurality of small rings hitched together. The chain attachment 4 further comprises a chain body encompassing a conductive shaft for a chair back rest of the chair. The chain body is also formed by a plurality of small rings hitched together. In order to fasten to the conductive shaft, the chain body is provided with a clasp which may clasp any small ring of the chain attachment.

[51] The chain attachment 4 encompassing a conductive shaft for a chair back rest of the chair is a metal, plastic or a combination of plastic and metal chain. One skilled in the

art knows that the chain attachment can be a metallic coiled spring with a clasp or any conductive plastic or metal strip with a clasp.

[52] Fig.4 shows comparison test data of the magnitude of the body voltages versus various types of ESD chair seat surfaces collected using a standard ESD smock of 5mm conductive grid lines at the test condition of 12% Relative Humidity (RH) for a standard static dissipative chair with chair seat fully covered by static dissipative material and that only covered by a static dissipative chair band (such as the chair band grounder shown in Fig.2) in Table 1.

[53] Surprising, there is practically no difference at all in the body voltage readings taken with full coverage of static dissipative material on the chair seat (type 1) compared to the one covered only by the static dissipative or conductive band 3 (type 2) in the current application.

[54] Test data collected in table 2 and table 3 clearly shown that there is also practically no difference at all in the body voltage readings taken with full coverage of static dissipative material on the chair seat compared to the one covered only by the static dissipative chair band 3 (type 2) in the current application.

[55] Another extreme comparison test was conducted with the static dissipative chair band 3 replaced by a coiled spring (Type 3) and a thin wire (Type 4) while all other design features and test parameters remains the same. Surprisingly, the body voltage reduction effectiveness of the coiled spring (type 3) and the thin wire (type 4) as shown in Table 1, Table 2 and Table 3 are as good as the chair cover and chair band as long as the chair seat to ground resistance is at the low static dissipative range of 1 x 10e5, 1 x 10e6 and 1 x 10e7 ohm.

[56] The present application clearly demonstrates that it is not the size of the chair seat contact surface area that really matters, it is the electrical resistance that results from the design of chair seat that is the utmost important insight factor for design consideration for an effective reduction of HBM human body voltage when an operator sits on an ESD chair seat with an objective to subsequently effectively draining away the body static voltage.

Claims

[Claim 1] 1. A chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm to 150mm, a first conductive attachment element fastened to one end of the static dissipative or conductive band and attached onto a chair, and a second conductive attachment element with one end electrically connecting itself to a centre rotating shaft of the chair and the other end fastend to the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground without accumulation of dust and particles.

[Claim 2] 2. The chair band grounder according to claim 1, wherein, the first conductive attachment element is a U-shape hook-like structure affixed to the one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith and hooked onto an edge of a chair seat of the chair at a region just below back rest of the chair.

[Claim 3] 3. The chair band grounder according to claim 1, wherein, the second conductive attachment element comprises a buckle that is hooked by a stretchable metallic coiled spring provided with a conductive hook underneath the chair seat.

[Claim 4] 4. The chair band grounder according to claim 3, wherein, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[Claim 5] 5. The chair band grounder according to claim 1, wherein, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

[Claim 6] 6. The chair band grounder according to claim 1, wherein, the static dissipative or conductive band is made of static dissipative or conductive plastic, metal, carbonized or non-carbonized material, or a combination of two or more of the aforesaid materials.

[Claim 7] 7. The chair band grounder according to claim 1, wherein, the static dissipative or conductive band is opaque, translucent, transparent or a combination of them.

[Claim 8] 8. The chair band grounder according to claim 1, wherein, the first conductive attachment element comprises a chain ring affixed to the

one end of the static dissipative or conductive band by heat-sealing, ultrasonic sealing, sewing, glue-on, staple, rivet, velcro, adhesive means or a combination of two or more of methods described herewith; and a chain body encompassing a conductive shaft for a chair back rest of the chair, wherein, the chain body is provided with a clasp for fixing the chain body to the conductive shaft, wherein, the chain ring and the chain body are formed by a plurality of small rings hitched together.

[Claim 9] 9. A chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm to 150mm, a U-shape hook-like structure fastened to one end of the static dissipative or conductive band and hooked onto an edge of a chair seat at a region just below back rest of a chair, and a buckle that is hooked by a stretchable metallic coiled spring provided with a conductive hook underneath the chair seat for connecting itself to a centre rotating shaft of the chair, wherein, the buckle is fastened to the other end of the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground without accumulation of dust and particles.

[Claim 10] 10. The chair band grounder according to claim 9, wherein, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[Claim 11] 11. The chair band grounder according to claim 9, wherein, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

[Claim 12] 12. A chair band grounder consisting of a static dissipative or conductive band with a width in a range of 0.1mm to 150mm, a chain attachment with a chain ring affixed to the one end of the static dissipative or conductive band and a chain body encompassing a conductive shaft for a chair back rest of the chair, and a buckle that is hooked by a stretchable metallic coiled spring provided with a conductive hook underneath the chair seat for connecting itself to a centre rotating shaft of the chair, wherein, the chain body is provided with a clasp for fixing the chain body to the conductive shaft, wherein, the chain ring and the chain body are formed by a plurality of small rings hitched together; the buckle is fastened to the other end of the static dissipative or conductive band, in such a way, static charges are surprisingly effectively drained from a human body to the chair and

subsequently to ground without accumulation of dust and particles.

[Claim 13] 13. The chair band grounder according to claim 12, wherein, the second conductive attachment element further comprises a resistor connected in series at any spot along any electrical path from the buckle to the centre rotating shaft of the chair.

[Claim 14] 14. The chair band grounder according to claim 12, wherein, the static dissipative or conductive band has a width in a range of 25mm to 50mm.

Abstract

A chair band grounder with a static dissipative or a conductive band is disclosed. The chair band grounder has a first conductive attachment element fastened to one end of the static dissipative or conductive band and attached onto a chair seat of a chair, and a second conductive attachment element electrically connecting itself to a centre rotating shaft of the chair fastened to the other end of the static dissipative or conductive band. In such a way, a normal chair is converted to an ESD chair quickly and inexpensively, and static charges are surprisingly effectively drained from a human body to the chair and subsequently to ground without accumulation of dust and particles.

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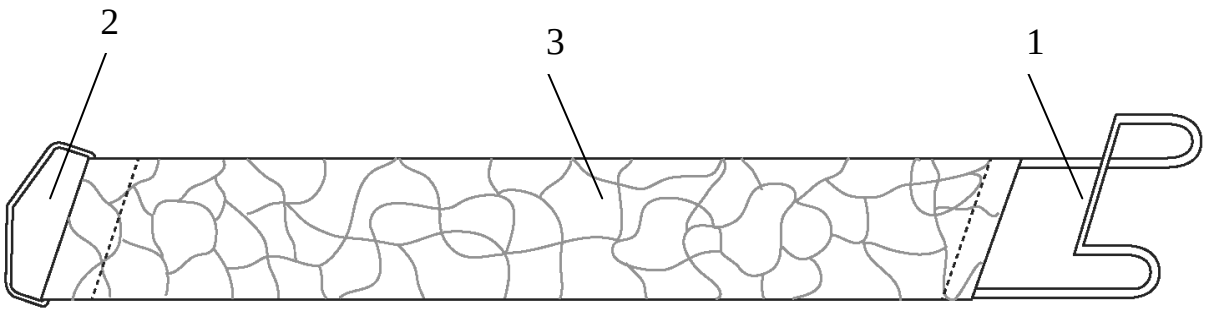

Fig.1

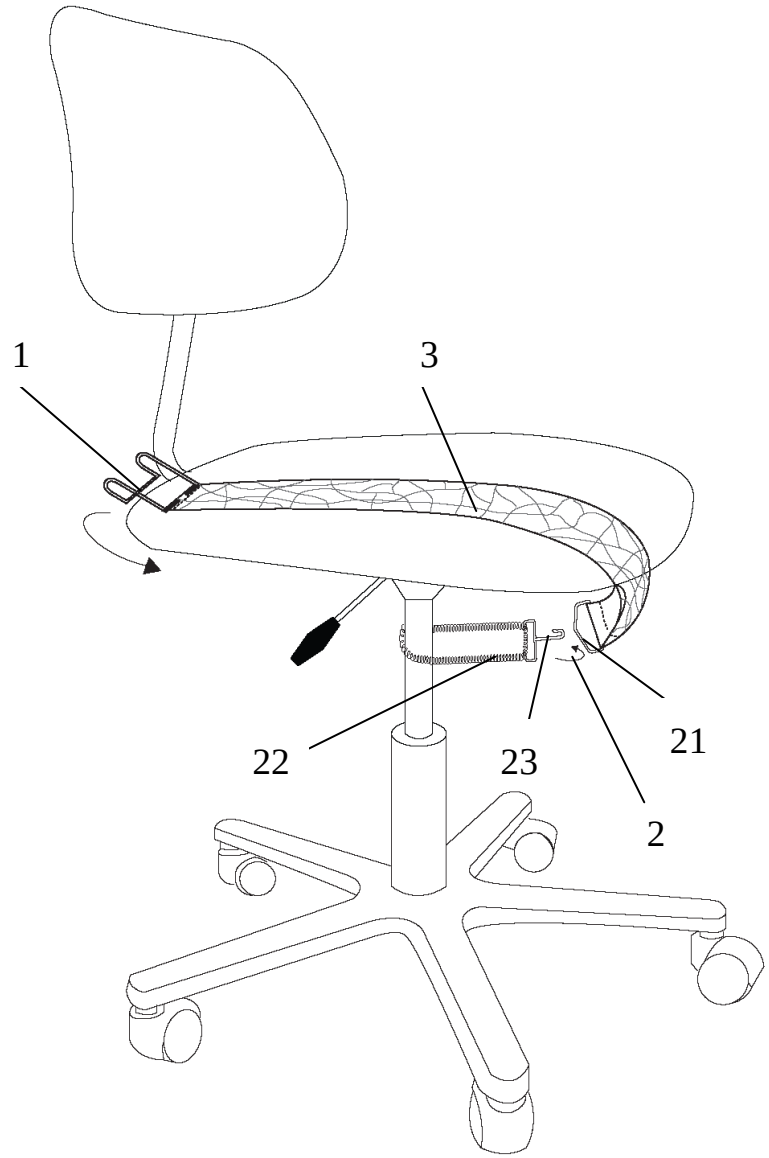

Fig.2

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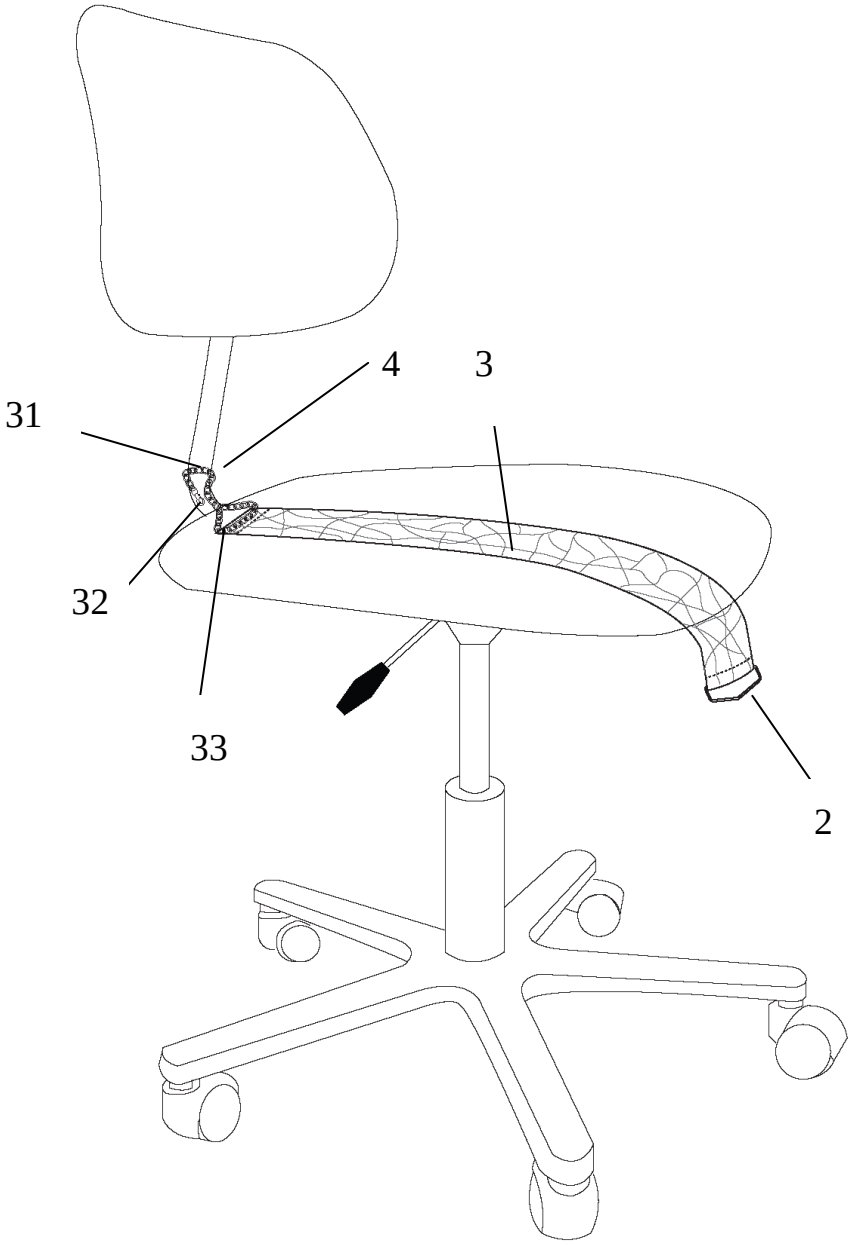

Fig.3

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Test Equipment: Wolfgang Warmbier Electrometer - WT 5000
Temperature : 21^0C
RH % : 12%, 30% & 50%
Reference: Test method modified form ESD/ANSI STM 97.2 (USA)

RH%: 12% **Table 1**

Chair seat to Ground Resistance (Ω)	Human Body Voltage (V) - (Peak Value)			
	Type 1	Type 2	Type 3	Type 4
	Chair Cover	Chair Band	Coiled Spring	Stainless steel wire
1 x E9	90	90	200	200
1 X E8	30	30	50	50
1 x E7	10	10	10	10
1 X E6	<10	<10	<10	<10
1 x E5	<10	<10	<10	<10

RH%: 30% **Table 2**

Chair seat to Ground Resistance (Ω)	Human Body Voltage (V) - (Peak Value)			
	Type 1	Type 2	Type 3	Type 4
	Chair Cover	Chair Band	Coiled Spring	Stainless steel wire
1 x E9	70	70	150	150
1 X E8	25	25	40	40
1 x E7	10	10	10	10
1 X E6	<10	<10	<10	<10
1 x E5	<10	<10	<10	<10

RH%: 50% **Table 3**

Chair seat to Ground Resistance (Ω)	Human Body Voltage (V) - (Peak Value)			
	Type 1	Type 2	Type 3	Type 4
	Chair Cover	Chair Band	Coiled Spring	Stainless steel wire
1 x E9	50	50	100	100
1 X E8	20	20	30	30
1 x E7	10	10	10	10
1 X E6	<10	<10	<10	<10
1 x E5	<10	<10	<10	<10

Fig.4