**Title:** MULTILAYER SURFACE COATING

**Abstract:** The present invention concerns a multilayer surface coating (100; 200; 300) comprising: a first flexible insulating layer (102; 202; 302), a second flexible insulating layer (110; 210; 310), and a first flexible conducting layer (104; 204; 304) arranged between the first insulating layer and the second insulating layer.
Multilayer surface coating

The present invention relates to a multilayer surface coating. Further, the present invention relates to a surface coating comprising two multilayer surface coatings arranged one onto the other. Finally, the present invention relates to a plug subassembly for multilayer surface coating.

Standard wiring in buildings provided to provide electrical power and/or data network communication to working places requires at an early stage a planning of the need of electrical outlets and data outlets, for example where sockets for the communication network and the power grid have to be placed. For that purpose, the floor is often provided with a hollow space below the floor surface, in which the cables are placed. Other solutions are to provide the cables in the base board and/or the sockets in the wall. In addition to the costs of the wiring itself, such an installation is time consuming. In case that the building is attributed to a new user or renter, every work station would require being unwired and most of the time a new space planning for a new user would not fit with the power and data outlet positions arranged for the previous user or renter. This issue is mainly solved by expensive electric interventions including recabling through ceiling, floor and/or wall bases. Otherwise, the position of electrical outlets will limit the freedom to place the working desks and work stations. Further, the architects are bound to the power and network grid provided by the building when they plan an office space. Thus, they are not free to position the work stations or working tables.

Building owners, contractors and architects are used to use traditional wiring cables from the building to the working places of work stations. Some solution exists in providing wireless power supply from a working table or working station to devices, for example by using induction connections. However, even in such a case a cable has to be provided to the working desk.

US 2008/0238216 A1 discloses a power floor tile assembly for providing power to furniture components via a floor structure, each tile including a substantially rigid supporting substrate member providing a plurality of visible contact terminals, which are provided to contact surfaces of a furniture. However, the power floor assembly requires a complicated wire structure in the floor, so that the production is expensive and complicated. Further, the contact surfaces of the furniture have to be accurately adapted to the distance of the contact terminals of the tiles. A complex control system is
necessary, to avoid short circuits and electrical accidents. Finally, the power floor assembly is rigid so that the installation is complicated.

Object of the invention is to provide a multilayer surface coating and a plug cooperating with the multilayer surface coating that are easy to install and provide a free placement of the work tables or work stations.

In the light of above, a multilayer surface coating is provided comprising: a first flexible insulating layer, a second flexible insulating layer, and a first flexible conducting layer arranged between the first insulating layer and the second insulating layer.

According embodiments of the multilayer surface coatings, it may have one or more of the following characteristics:
- the first insulating layer is more rigid than the second insulating layer and/or the first insulating layer is thinner than the second insulating layer,
- the first flexible, conducting layer is laminated on the second flexible, insulating layer,
- it is comprising at least one second flexible conducting layer and at least one third flexible insulating layer, wherein second flexible conducting layer and the third insulating layer are arranged alternatingly below the second insulating layer, one second conducting layer being arranged between the second insulating layer and the third insulating layer,
- the third insulating layer has a smaller thickness than the second insulating layer,
- the first insulating layer is laminated on the first conductive layer.
- a flooring product, in particular a carpet product, is applied on the first insulating layer,
- the multilayer surface coating is further comprising a printing support layer and a printed layer between the first insulating layer and the first conducting layer,
- the second insulating layer and/or the third insulating layer have a thickness of 0,5mm to 10mm, in particular 1mm to 5mm,
- the second insulating layer and/or the third insulating layer is a layer based polyvinylchloride, polyurethane and/or silicon.
- the second insulating layer and/or the third insulating layer is a foamable or non-foamable layer, for example a memory foam.
- the first insulating layer is a layer based on polyvinylchloride and/or polyurethane,
- the first flexible conducting layer and/or the second flexible conducting layer comprises a conductive metal, for example copper, conductive polymers, conductive inks and/or conductive materials,
- the first flexible conducting layer and/or the second conducting layer are adapted to conduct low voltage currents, in particular currents below 50V, for example currents below 20V,

- the multilayer surface coating further comprises a flexible base layer, wherein the second insulating layer or the third insulating layer is laminated on the base layer, wherein the base layer has a rigidity higher than the rigidity of the second insulating layer and/or the third insulating layer,

- the base layer comprises impregnated glass fibers, for example an impregnated glass veil.

According to a further aspect, a surface coating is provided comprising two multilayer surface coatings according to one of the preceding claims arranged one onto the other.

According embodiments of the surface coatings, it may have one or more of the following characteristics:
- the surface coating further comprises a flooring product arranged on the upper multilayer surface coating,

According to an embodiment, the multilayer surface coating according to an embodiment disclosed herein and/or the surface coating according to an embodiment disclosed herein may have a total thickness of about 5 to 20mm.

According to a further aspect, a plug subassembly for a multilayer surface coating, in particular according to an embodiment disclosed herein, or for a surface coating, in particular according to an embodiment disclosed herein, is provided, comprising: at least one pin defining a plugging direction in the longitudinal direction thereof, a first contacting surface arranged at a first position in longitudinal direction, a second contacting surface arranged at a second position in longitudinal direction, the second position being different to the first longitudinal direction, the first and second contacting surfaces are provided to establish an electrical contact respectively to a conductive layer in the multilayer surface coating or surface coating.

According embodiments of the plug subassembly, it may have one or more of the following characteristics:
- the plug subassembly may further comprise an abutting surface, the abutting surface having a predefined distance in longitudinal direction to the first and second contacting surfaces,
- the plug subassembly may further comprise at least two pins, the a pin being provided
with the first contacting surface, the second pin being providing with the second contacting
surface, wherein, in particular the first pin has a different length in longitudinal direction
than the second pin,

- the distance in longitudinal direction between the first contacting surface and the second
contacting surface is between 0.5 and 7mm.

According to a further aspect, an assembly is provided comprising a multilayer surface
coating according to an embodiment disclosed herein or a multilayer surface according to
an embodiment disclosed herein and a plug subassembly according to an embodiment
disclosed herein, wherein in particular the plug subassembly is inserted into the multilayer
surface coating, so that the first contacting surface contacts the first conducting layer and
the second contacting surface contacts the second conducting layer.

Further advantages, features, aspects and details are evident form the dependent
claims, the description and the drawings. The accompanying drawings will relate to
embodiment of the invention and are described in the following:

Figure 1 is a schematically exploded perspective view of an embodiment of a
multilayer surface coating according to the invention,

Figure 2 is a perspective view of the embodiment of figure 1 of the multilayer surface
coating,

Figure 3 is an exploded perspective view of a surface coating comprising two
multilayer surface coatings according to figures 1 and 2,

Figure 4 is a perspective view of the assembled surface coating of figure 3 including
a plug subassembly,

Figure 5 is an exploded perspective view of another embodiment of the multilayer
surface coating according to the invention,

Figure 6 is a perspective view of the embodiment of figure 5,

Figure 7 is a perspective view of the embodiment of figure 5 with a flooring surface
product and a plug sub assembly,

Figure 8 is an exploded perspective view of a further embodiment of the multilayer
surface coating according to the invention,

Figure 9 is a perspective view of the embodiment of figure 8,

Figure 10 shows the embodiment of figure 9 with a plug subassembly,
Figure 11 shows a perspective view of a plug subassembly for a plug according to an embodiment of the invention,

Figure 12 shows a top view of the plug subassembly of figure 11,

Figure 13 shows a side view of the plug subassembly of figure 11 according to the view XIII of figure 11,

Figure 14 shows a side view of the plug subassembly of figure 11 according to the view XIV of figure 12,

Figure 15 shows a perspective view of a surface coating according to Fig. 4 with a plug subassembly according to the embodiment of figure 11, halfway inserted therein,

Figure 16 corresponds to the figure 15 with the plug subassembly completely inserted into the surface coating according to Fig. 4,

Figure 17 shows a perspective view of a plug according to another embodiment,

Figure 18 shows the plug of figure 17 inserted halfway into a surface coating according to the invention, and

Figure 19 shows the plug of figure 17 completely inserted into the surface coating according to the invention.

Reference will now be made in detail to the various embodiments, one or more examples of which are illustrated in the figures. Each example is provided by way of explanation, and is not meant as a limitation of the invention. Within the following description of the drawings, the same reference numbers refer to the same components. Generally, only the differences with respect to the individual embodiments are described.

Figure 1 and 2 show a first embodiment of a multilayer surface coating 100 according to the invention. The multilayer surface coating may be part of a surface coating provided on the floor of a building. The multilayer surface coating 100 and/or surface coating comprises a plurality of flexible layers, so that the multilayer surface coating 100 and/or surface coating may be rolled up into a rolled state, can be transported in the rolled state and unrolled in the places, where the multilayer surface coating has to be installed. The surface coating or multilayer surface coating according to embodiments disclosed herein may be used to coat floor surfaces, wall surfaces or surfaces inside a vehicle, for example railway vehicles, cars or planes.

According to an embodiment, the multilayer surface coatings according to the invention are produced with a width greater than 2 meters, for example having a width of more than 4 meters.
In the following, "upper", "lower", "above" and "below" refer to the surface coating and/or multilayer surface coating installed on a surface for use, for example the floor surfaces, the wall surfaces or the surfaces inside a vehicle, so that the upper surface is visible or directed to a user and the lower surface thereof is connected or directed to the floor surface, the wall surface or the vehicle body. The a first layer being above a second layer is more close to the user than said second layer:

Further, the terms "insulating" and "conducting" refer to insulating or conducting an electrical current. Accordingly a conducting layer has a very low resistance and an insulating layer has a very high resistance.

The multilayer surface coating 100 of figures 1 and 2 comprises a first flexible insulating layer 102, for example in form of a protective layer 102. The first flexible insulating layer 102 is based, according to an embodiment, on polyvinylchloride (PVC) or polyurethane (PU). The first insulating layer or protective layer 102 is provided in an embodiment to cover an upper outer surface of the multilayer surface coating 100. Thus, the first insulating or protective layer 102 of the multilayer surface coating is provided in direction of the user and prevents or limits the penetration of dirt into the multilayer surface coating 100. In an embodiment, the first insulating layer 102 has a thickness of 0,5 to 2mm.

Further, the multilayer surface coating 100 comprises a conductive layer 104 comprising a strand 106 with a contacting surface 108 for connecting the conductive layer to a power supply (not shown). For example, the conductive layer 104 may comprise a plurality of strands 106, so that when the multilayer surface coating 100 is installed on a surface, the user has a free choice where to connect the conductive layer 104 to one or more power supplies.

According to an embodiment, the conductive layer may comprise conductive metals, for example copper, conductive polymers, conductive inks, and/or carbon materials as conducting material.

Below the conductive layer, a second insulation layer 110 and a base layer 112 are provided. As it can seen from figure 2, all the layers 102, 104, 110, 112 are laminated together. Thus, according to an embodiment, the conductive layer 104 is applied or
laminated onto the insulating layer 110. Thus, the conductive layer 104 is provided between the first insulating layer 102 and the second insulating layer 110.

According to an embodiment, which may be combined with other embodiments disclosed herein, the base layer 112 may comprise glass fibres which are bounded or impregnated with a resin, for example an impregnated glass veil. Thus, the base layer is a rigid layer having a rigidity higher than the rigidity of the insulating layer.

The second insulating layer may be based on PU, PVC, or silicon, for example a memory foam or a hyper plasticized PVC material. The second insulating layer may have a thickness of 1mm to 5 mm.

According to an embodiment, the second insulation layer may comprise 30% PVC by weight, 55% inorganic fillers and 14% plasticizer by weight.

The second insulating layer 110 may be non-foamable or foamable, in the case of an foamable second insulating layer 110, said layer comprises one or more blowing agents, such as a sulfonyl hydrazone, for example \( P,P' \)-oxy bis benzene sulfonyl hydrazone, or an azodiearbonamide, for example Unifoam AZ ULTRA 7043 or Ultra 1050.

According to an embodiment, which may be combined with other embodiments enclosed herein, the PVC-based foamable second insulating layer 110 comprises 100 per of Pevikon® PVC P6S2 and Pevikon® DP 2170, 117 per of calcium carbonate (Omya BL 20) used as an inorganic filler, 2.9 per of a blowing agent, an azodiearbonamide (Porofor ADCL-C2), 1.38 per of zinc oxide (ZnO) used to lower the decomposition temperature of the blowing agent, 0.7 per of Titanium RC 82, 30.3 per of DIHP (Jayflex 77), 26.2 per of DIBP (Palatinol® IC), and 14.5 per of a dearomatized hydra- carbon used as a viscosity reducer (Exxsol D100), "per" referring to the percentage in relation to the quantity of PVC.

According to an embodiment, which may be combined with other embodiments enclosed herein, the PVC-based non-foamable second insulating layer 110 comprises 100 per of Lacovyl PVC PB 1702 H, 156 per of inorganic filler (Omya BL20), 45 per of DIHP (Jayflex 77), 28 per of DIBP (Palatinol IC) and 5 per of viscosity reducer (Exxsol D100), "per" referring to the percentage in relation to the quantity of PVC.
The PVC film comprising inorganic fillers comprises 100 per cent of Evipol PVC 6030, 100 per cent of calcium carbonate (Imerys Micronic P5) used as an inorganic filler and 33 per cent of DINP plasticizer by Exxon and 6 per cent of Lagor stabilizer (Lastab S DC1211).

Thus, the conductive layer 104 is separated from the environment by two insulating layers 102, 110. In an embodiment, the first insulating or protective layer has a higher rigidity than the second insulating layer.

The multilayer surface coating shown in figures 1 and 2 comprises only a single conductive layer 104. Therefore, as it is shown in figures 3 and 4, two multilayers surface coatings 100a, 100b are superimposed to provide a surface coating with two conductive layers 104a, 104b. The features identical to the features of the multilayer surface coating 100 of figures 1 and 2 are provided with the same reference signs with an added letter "a" for the upper multilayer surface coating or "b" for the lower multilayer surface coating.

Two identical multilayer surface coatings 100a, 100b are for example assembled together, for example by a loose lay or connected with a glue. The surface coating comprises two conductive layers. Further, the surface coating is covered by a flooring product 130, for example a resilient flooring product or a carpet flowing product. Here, the surface coating comprises three superimposed layers, namely the flooring product 130, an upper multilayer surface coating 100a, and a lower multilayer surface coating 100b. Thus, according to an embodiment of the invention, the super imposed multilayer surface coatings 100a, 100b could be considered as an underlayer of the flooring products. Such an assembly may be manufactured efficiently and with reduced costs as two identical multilayer surface coatings 100a, 100b are used. In other embodiments, the surface coating may comprise three or more multilayer surface coatings 100, to provide even further conducting layers, for example if two different voltages should be provided for the power supply for devices.

Figure 4 shows a connection interface or plug subassembly 140 inserted into the surface coating. The plug subassembly 140 comprises a first cylindrical pin 142 having a longitudinal axis defining the plugging direction P. The pin comprises an insulated portion 144 and a contacting surface 146 at the point thereof. The plug 140 comprises a second pin 148 being longer in the plugging direction P than the first pin 142. The second 148 has an insulating portion 150 and a contacting surface 152 at the point of the pin 148. Further,
the plug comprises a base plate 154 providing an abutting surface 156, which is adapted to come into contact with the upper surface of the flooring product 130.

When the plug subassembly is completely inserted into the surface coating, as shown in Fig. 4 that means that the abutting surface contacts the upper surface of the flooring product 130, the contacting surface 146 of the first pin 142 contacts the conductive layer 104a of the upper multilayer surface coating 100a and the contacting surface 152 of the second pin 148 contacts the conductive layer 104b of the lower multilayer surface coating 100b.

In an embodiment the plug subassembly may even have more than two pins having each a contacting surface. In a further embodiment, the plug subassembly may even have only one pin comprising two contacting surfaces spaced apart from each other in plugging direction. We will describe in further detail the plug subassembly with respect with figures 11 to 16.

Figures 5 to 7 show a further embodiment of a multilayer surface coating according to the invention. The same reference numbers refer to the same features as to the embodiment of figure 1 increased by 100.

In contrast to the embodiment shown in figures 1 and 2, the multilayer surface coating 200 comprises two flexible conductive layers 204, 214, namely a first flexible conductive layer 204 and a second flexible conductive layer 214. The second conductive layer 214 is provided below the second insulating layer 210 and above a third flexible insulating layer 220, which is laminated on the base layer 212. Thus, the second conductive layer 214 sandwiched between the second and the third insulating layers 210, 220. The second conductive layer 214 comprises like the first conductive layer 204 at least one strand 216 with a contacting surface 218 to connect the second conductive layer as a power supply or an telecommunication network. The second conductive layer 214 is identical to the first conductive layer 204, for example it comprises a conductive metal, for example copper, conductive polymers, conductive inks and/or carbon materials. In an embodiment, the strands 206, 216 of the first and second conductive layer are spaced apart from each other in horizontal direction (layer direction), when the multilayer surface coating is expanded on a floor.
The third insulating layer 220 is based on the same materials as the second insulating layer 210. The second and third insulating layers 210, 220 may have a different thicknesses. For example, in an embodiment, the third insulating layer 220 has a smaller thickness than the second insulating layer 210.

As it is shown in figure 7, the multilayer surface coating 200 may be used as an underlayer onto which a flooring product 230 like a resilient flooring product or a carpet flowing product may be applied, as in the embodiment of the surface coating described with respect to figure 4.

In other embodiments, the multilayer surface coating 200 may even comprise more than two flexible conductive layers, which are electrically insulated between them by respectively a flexible insulating layer, which may have the chemical and/or physical characteristics of the flexible second or third insulating layer.

Figure 7 shows a plug subassembly 240 having two pins 242, 248 inserted into the multilayer surface coating 200 and the flooring product 230. However, the pins 242, 248 of the plug subassembly may have different lengths with respect to the pins 142, 148 of the plug subassembly of figure 4, as the distance between the upper surface of the flooring product 230 and the first and second conductive layers 204, 214 may be different to the distance between the flooring surface of the flooring product 130 and the conductive layers 104a, 104b of the surface coating of figure 4. In other words, the distances in plugging direction between the contacting surfaces 146, 152 of the plug subassembly 140 and the abutting surface 156 is different to the distances between the contacting surfaces 246, 252 and the abutting surface 256 of the plug subassembly 240.

Figures 8 to 10 show another embodiment of a multilayer surface coating 300 according to the invention. The same features are provided with the same reference numbers as the embodiment shown in figures 5 to 7 increased by 100.

Additionally to the embodiment of figure 5, the multilayer surface coating 300 includes a printing support layer 322 provided on the first conducting layer 304 and a printed decor layer 324 printed on the printing support layer 322.

The first insulating or protective layer 302 is provided or laminated on the printed decor layer 324. The multilayer surface coating 300 can be considered as a flooring
product and would not require an additional flooring product on the top, like in the previous embodiments. Thus, only one layer would have to be installed on the floor of a building.

On figure 10 also a plug 340 acting as a connection interface is provided having like the previous plugs 140, 240 to pins 342, 348 with respectively a contacting surface 346, 356 which are arranged in a different distance to the base 354 in plugging direction P. However, the pins 342, 348 of the plug subassembly may have different lengths with respect to the pins 142, 148, 242, 248 of the plug subassemblies of figure 4 and 7, as the distance between the upper surface of the insulting or protective layer 302 and the first and second conductive layers 304, 314 may be different to the distance between the flooring surface of the flooring products 130, 230 and the conductive layers 104a, 104b, 204, 214 of figures 4 and 7. In other words, the distances in plugging direction between the contacting surfaces 146, 152, 246, 252 of the plug subassembly 140, 240 and the abutting surface 156, 256 is different to the distances between the contacting surfaces 346, 352 and the abutting surface 356 of the plug subassembly 340.

In an embodiment, the multilayer surface coatings 200, 300 and the surface coating according to figure 4 will have a global thickness between 5 and 20 mm. The upper or first conducting layer would be covered by the first insulating protective layer and would be separated from the second conducting layer by a layer ensuring power insulation. The second conducting layer would be on its lower surface covered with a foam (insulating layer) and a base layer 112, 212, 312.

This construction would ensure physical conductive layer insulation. In addition, when the multilayer surface coating according to embodiments enclosed herein is perforated through its entire thickness, the second insulating layer and/or third insulating layer, for example produced by a memory foam, silicon or hyper plasticized PVC material, between the two conductive layers would in case of liquid spillage ensure a perfect sealing between them, because the second insulating layer and/or third insulating layer would expand again into the holes created by the pins of the plug subassembly.

In an embodiment, the first conductive layer and the second conductive layer would be supplied by a low voltage current power supply through a connection included within a wall base. Thus, the two superposed conducting layers 104, 204, 214, 304, 314, can be considered as phase and neutral of an electrical power supply.
In order to retrieve the current from the conductive layers a plug subassembly or electrical interface may be used. In the following, we will describe the embodiments of the plug subassembly 140 with respect to the figures 11 to 16 and a plug with respect to figures 17 to 19. The description of the plug subassembly 140 also applies to the embodiments of the plug subassemblies 240, 340.

The plug subassembly comprises two pins having respectively a different length and respectively a contact surface. The pins will perforate the multilayer surface coating, so that the contact surfaces 146, 148 of the plug 140 come into contact with the conducting layer 104a, 104b allowing the power supply of low voltage devices. For example, low voltage devices may be devices consuming a current below 50 Volt, in particular below 20 Volt.

Figures 11 to 16 show a first embodiment of a plug subassembly 140 which may be used with a multilayer surface coating according to an embodiment of the invention. The plug 140 comprises first pin 142 and a second pin 148 respectively extending into a plugging direction P. Each pin has a substantially cylindrical form. However, in other embodiments, each pin may have another form in cross section, for example rectangular form.

Each pin comprises an insulating portion 144, 150 and respectively a contacting surface 146, 152.

The contacting surfaces 146, 152 are provided to contact respectively a conductive layer 104a, 104b of the surface coating. For example, the coating surfaces 146, 152 may be metallic and arranged at the point of the pins 142, 148. The insulating portions extend between a base plate 154 and the contacting surfaces 146, 152 in plugging direction.

Further, the plug 140 comprises a base plate 154 having an abutting surface 156 directed downwardly. The contacting surfaces 146, 152 are provided at a different distance to the abutting surface 156 in plugging direction P. Thus, when the plug 140 is completely inserted into a surface coating as shown in figure 16, the two contact surfaces 146, 152 are provided in a different depth so that they can contact different conducting layers 104a, 104b.
On the upper side of the base 154, two electrical device contacts 158, 160 are provided to enable an electrical connection to a device. The device contacts 158, 160 are respectively connected to the respective contact surfaces 146, 152 of the first pin and the second pin.

The length of the first and second pin 142, 148 are adapted, so that when the plug 140 is completely inserted into the surface coating, a complete perforation of the surface coating is avoided. In the embodiment shown in figures 11 to 16, the second pin is longer than the first pin, so that the point of the first and second pin contacts the respective conducting layer and ensures that a large surface area of the contacting surfaces is in contact with the respective conductive layer.

In other embodiments both pins may have the same length. For example, in case the first pin 142 has the same length as the second pin 148, the contacting surface 146 is not provided at the point of the pin, but in a middle portion thereof. Then, a second insulating portion is provided on the surface of the pin between the contacting surface 146 and the point of the pin.

As it is shown in figures 15 and 16, the contact surfaces 146, 152 are provided with a different distance to the abutting surface 156 so that they never contact the same conductive layer 104a, 104b so that short circuits can be avoided.

According to an embodiment, the distance in plugging direction between the contacting surfaces 146, 152 is adapted to the thickness of the insulating layer 110a being arranged between the conductive layer 104a of the first multilayer surface coating 100a and the conductive layer 104b of the second multilayer surface coating 100b, or in other words adapted to the distance between a first conductive layer and a second conductive layer respectively being in contact with one of the contacting surfaces 146, 152.

Further, the extension of the contact surfaces 146, 152 is adapted to provide a reliable contact to the conductive layers 104a, 104b. For example, the extension in plug-in direction of the contact surfaces 146, 152 is between 0.5 and 3 mm.

In other embodiments, the plug subassembly may comprise even more than two pins or only a single pin. In case of a single pin, the two or more contacting surfaces are
spaced apart in plugging direction the pin and insulating portions are provided between the contacting surfaces.

Figures 17 to 19 show an embodiment of a plug 440. The same reference numbers refer to the same features as in the embodiment of figures 11 to 16, increased by 300.

The plug 440 may comprise a plug subassembly according to figures 11 to 16, however the base plate 350 has another form. For example, the base plate 350 of the plug 440 is substantially rectangular with a respective abutting surface 456.

The device contacts are covered by a housing 462 into which a power cable 464 connected to the device is inserted. The conductors of the power cable 464 are electrically connected to the contact surfaces 446, 452. Thus, by simply inserting the plug 440 to the surface coating, a device can be provided with an electrical current.

Thus, the vast majority of devices, for example laptops, cameras, mobile phones, tablets may be powered using the plug according to the invention, inserted into the multi-layer surface coating according to the invention as they do not require a 220 V or 110 V power supply as they are powered by low voltage, for example, lower than 20 V. Thus, the plug or plug subassemblies 140, 240, 340, 440 can be inserted anywhere in the floor such that an electrical connection is established to the conducting layers. The plugs could be located under the desk and provide the power cable on the top of the desk or could be located under free standing lamps or such appliances.

Further, in another embodiment, which may be combined with embodiments enclosed herein, power line communication or broad band over power line may be used to transmit data via the conducting layers of the multi-layer surface coatings in the floor, such that the devices are powered by the plug may also be connected by the plug to a network.

Thus, working desk can be placed anywhere on the floor and modern information equipment, for example computers, lamps, etc, may be instantly connected to the power network and/or a data network.

According to a further embodiment, the first conducting layer and/or the second conducting layer may be used to be connected to an alarm device. For example, the alarm device may use characteristics of the system to detect people motion on the floor or
within the space, for example by a change of the capacity of the conductive layers. Thus, the present invention may also be directed to an alarm device comprising a multi-layer surface according to one of the embodiments disclosed herein.

Thus, the invention solves the needs of customers and architects as they can place the working desk, workstations or appliances very easily and quick anywhere within the space or building and the architects get rid of the building grid. Further, the working desk and workstations may easily and quickly be located as complicated un-cabling and re-cabling in the floor is not required. Further, the owners of a building may save costs for providing cabling, power boxes and installation.
1. Multilayer surface coating (100; 200; 300) comprising:
a first flexible insulating layer (102; 202; 302),
a second flexible insulating layer (110; 210; 310), and
a first flexible conducting layer (104; 204; 304) arranged between the first insulating layer
and the second insulating layer.
2. Multilayer surface coating according to claim 1, wherein the first insulating layer
(102; 202; 302) is more rigid than the second insulating layer (110; 210; 310) and/or the
first insulating layer is thinner than the second insulating layer.
3. Multilayer surface coating according to any of the preceding claims, wherein the
first flexible conducting layer (104; 204; 304) is laminated on the second flexible,
insulating layer (110; 210; 310).
4. Multilayer surface coating according to any of the preceding claims, further
comprising at least one second flexible conducting layer (214; 314) and at least one third
flexible insulating layer (220; 320), wherein second flexible conducting layer and the third
insulating layer are arranged alternatingly below the second insulating layer, one second
conducting layer being arranged between the second insulating layer and the third
insulating layer.
5. Multilayer surface coating according to claim 4, wherein, the third insulating layer
(220; 320) has a smaller thickness than the second insulating layer (110; 210; 310).
6. Multilayer surface coating according to any of the preceding claims, wherein the
first insulating layer (102; 202) is laminated on the first conductive layer (104; 204).
7. Multilayer surface coating according to any of the preceding claims, wherein a
flooring product, in particular a carpet product (130; 230), is applied on the first insulating
layer (102; 202).
8. Multilayer surface coating according to any of the claims 1 to 5, further comprising
a printing support layer (322) and a printed layer (324) between the first insulating layer
(302) and the first conducting layer (304).
9. Multilayer surface coating according to any of the preceding claims, wherein the
second insulating layer (110; 210; 310) and/or the third insulating layer (220; 320) have a
thickness of 0,5mm to 10mm, in particular 1mm to 5mm.
10. Multilayer surface coating according to any of the preceding claims, wherein the second insulating layer (110; 210; 310) and/or the third insulating layer (220; 320) is a layer based polyvinylchloride, polyurethane and/or silicon.

11. Multilayer surface coating according to claim 7, wherein the second insulating layer (110; 210; 310) and/or the third insulating layer (220; 320) is a foamable or non-foamable layer, for example a memory foam.

12. Multilayer surface coating according to any of the preceding claims, wherein the first insulating layer (102; 202; 302) is a layer based on polyvinylchloride and/or polyurethane.

13. Multilayer surface coating according to any of the preceding claims, wherein the first flexible conducting layer (104, 104a, 104b; 204; 304) and/or the second flexible conducting layer (214; 314) comprises a conductive metal, for example copper, conductive polymers, conductive inks and/or conductive materials.

14. Multilayer surface coating according to any of the preceding claims, wherein the first flexible conducting layer 104, 104a, 104b; 204; 304) and/or the second conducting (214; 314) layer are adapted to conduct low voltage currents, in particular currents below 50V, for example currents below 20V.

15. Multilayer surface coating according to any of the preceding claims, further comprising a flexible base layer (112; 212; 312), wherein the second insulating layer (110) or the third insulating layer (220; 320) is laminated on the base layer, wherein the base layer has a rigidity higher than the rigidity of the second insulating layer and/or the third insulating layer.

16. Multilayer surface coating according to claim 15, wherein the base layer (112; 212; 312) comprises impregnated glass fibers, for example an impregnated glass veil.

17. Surface coating comprising two multilayer surface coatings (100a, 100b) according to one of the preceding claims arranged one onto the other.

18. Surface coating according to claim 17, further comprising a flooring product (130) arranged on the upper multilayer surface coating.

19. Multilayer surface coating according to any of the claims 10 to 16 or the surface coating according to claims 17 or 18 having a total thickness of about 5 to 20mm.
20. Plug subassembly (140; 240; 340; 440) for a multilayer surface coating, in particular according to any of the claims 1 to 17 and 19, and/or for a surface coating according to any of the claims 17 to 19, comprising:

at least one pin (142, 148; 242, 248; 342, 348, 442, 448) defining a plugging direction (P) in the longitudinal direction thereof,

a first contacting surface (146; 246; 346; 446) arranged at a first position in longitudinal direction,

a second contacting surface (152; 252; 352; 452) arranged at a second position in longitudinal direction, the second position being different to the first longitudinal direction, the first and second contacting surfaces are provided to establish an electrical contact respectively to a conductive layer in the multilayer surface coating or surface coating.

21. Plug subassembly according to claim 20 further comprising:

an abutting surface (156, 256, 356, 456), the abutting surface having a predefined distance in longitudinal direction to the first and second contacting surfaces.

22. Plug subassembly according to one of the claims 20 to 21, comprising at least two pins, the first pin (142; 242; 342; 442) being provided with the first contacting surface (146; 246; 346; 446), the second pin (148; 248; 348; 448) being providing with the second contacting surface, wherein, in particular the first pin has a different length in longitudinal direction (P) than the second pin.

23. Plug subassembly according to one of the claims 20 to 22, wherein the distance in longitudinal direction between the first contacting surface and the second contacting surface is between 0.5 and 7mm.

24. Assembly comprising a multilayer surface coating according to one of the claims 1 to 17 or 19 or a multilayer surface according to any of the claims 17 to 19 and a plug subassembly according to any of the claims 20 to 23, wherein in particular the plug subassembly is inserted into the multilayer surface coating, so that the first contacting surface contacts the first conducting layer and the second contacting surface contacts the second conducting layer.
A. CLASSIFICATION OF SUBJECT MATTER

INV. E04F15/10 H01R4/24 H01R24/58 F21V21/08

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04F H01R F21V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier application or patent but published on or after the international filing date
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  *P* document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search: 29 October 2013

Date of mailing of the international search report: 07/11/2013

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, 340-3016
Fax: (+31-70) 340-3016

Authorized officer: Fournier, Thomas
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