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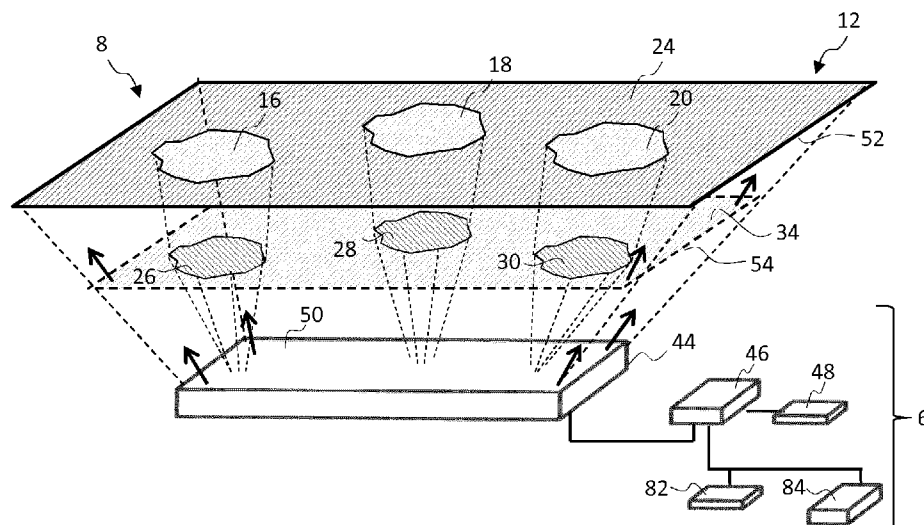


FIG. 1

(57) **Abstract:** The invention provides a surface lighting system (6) for installation behind a surface covering layer, such as beneath a floor covering layer (12), wherein the surface lighting system is configured to generate a light output for transmission through the surface covering layer having a spatial intensity distribution adapted to alter the degree of homogeneity of light output through the surface covering layer. A lighting assembly (44) is controlled in accordance with control instructions, which optionally may be stored in a data storage element (48), to generate a light output pattern having a non-homogeneous intensity distribution which is based upon a non-homogeneous transmissivity of the surface covering layer. In particular examples, the intensity distribution may be complementary with the non-homogeneous transmissivity so as to at least partially counter the non-homogeneous transmissivity upon transmission through said surface covering layer.

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LIGHT-EMITTING SURFACE COVERING SYSTEM

FIELD OF THE INVENTION

This invention relates to a light-emitting surface covering system, in particular to a light emitting flooring system. The invention also relates to a method of commissioning such a light-emitting surface covering system, and to a method of modifying a luminous
5 inhomogeneity of such a light-emitting surface covering system.

BACKGROUND OF THE INVENTION

Advances in lighting technology (most notably for example advances in LED lighting technology) have enabled a range of new decorative and functional lighting
10 applications. One particular application is that of surface lighting systems, such as ceiling, wall or floor lighting systems, in which lighting displays are incorporated within dedicated ceiling covering, wall covering or flooring arrangements to provide decorative effects or to communicate information to observers.

To ensure seamless incorporation of the lighting within the surface, source
15 luminaires are typically installed in dedicated cavities or spaces behind the surface covering layer, such as behind a floor covering layer. Light from the luminaire is transmitted through the surface covering layer to facilitate the illumination effects.

WO-2016/046364 discloses a floor construction having a plurality of layers including a top layer and a subjacent layer underneath the top layer, wherein light sources are
20 arranged in a pattern in the subjacent layer. The top layer is translucent so as to hide the light sources as well as the pattern when the light sources are off, and to reveal the pattern when the light sources are on.

One difficulty with this approach is that the optical properties of the light can often become distorted upon transmission through the surface covering layer. In particular,
25 depending upon the physical and optical properties of the surface covering layer, the apparent intensity and/or colour of the output light can vary between different portions or regions of the surface covering layer.

It is an object of the present invention to reduce the luminous distortion of light patterns transmitted through the surface covering layer of a surface lighting system.

SUMMARY OF THE INVENTION

The inventors of the present invention have recognised that the distortion of light emitted from surface lighting systems may be caused by inhomogeneity in the optical transmissivity of the particular surface covering layer employed. For instance, , if the surface covering layer is a floor covering layer, different colour patterns, yarn densities and height variations of carpet coverings or the patterning or relief structures of vinyl or wood coverings may lead to a spatial variation in the light transmissivity of the flooring layer. For similar reasons, a ceiling or wall covering layer may have a spatial variation in the light transmissivity. In such cases, even a perfectly uniform source illumination would fail to generate a uniform visible light output after transmission through the surface covering layer. Alternatively, such a surface covering layer intentionally may have a spatially inhomogeneous transmissivity, e.g. in cases where the surface covering layer is designed to display a luminous image and/or message.

Embodiments of the invention seek to adjust, e.g. counter or amplify, the distortion in luminous output without limiting the freedom of design in selecting the surface covering.

The invention is defined by the claims.

According to a first aspect of the invention, there is provided a light-emitting surface covering system comprising a surface lighting system and a surface covering layer having a non-homogeneous light transmissivity, being a light transmissivity that varies as a function of position across the surface covering layer. The surface lighting system comprises: a lighting assembly for directing a light output onto a light receiving surface of the surface covering layer, the light output having a configurable intensity distribution; and a controller adapted to control the lighting assembly in response to control instructions for controlling the lighting assembly, the control instructions being for realising a light output having a non-homogeneous intensity distribution, being an intensity distribution that varies as a function of position across the light receiving surface of the surface covering layer, based on the non-homogeneous light transmissivity of the surface covering layer. The intensity distribution of the light output provided by the lighting assembly is complementary to the light transmissivity of the surface covering layer to at least partially counter the light transmissivity upon transmission of the light output through the surface covering layer.

Embodiments of the invention are hence based on the concept of accounting for inhomogeneity in the light transmissivity of the surface covering layer through prior

modulation of the light source which is directed through the surface covering layer. The light source is modulated in a way which is based on the inhomogeneous transmissivity pattern of the surface covering layer so as to compensate for or amplify the inhomogeneous transmissivity. By thus modulating the intensity pattern of the light directed through the surface covering layer, the resultant light output emitted from the surface lighting system after transmission through the surface covering layer may be rendered less or more distorted. In this way, any desired light effect may be faithfully generated from the surface lighting system despite the non-uniform transmittance properties of the surface covering layer.

The invention provides a light-emitting surface covering system wherein a lighting system is installed behind a surface covering layer, such as beneath a floor covering layer, the surface covering layer having a particular non-homogeneous light transmissivity, being a light transmissivity that varies as a function of position across the surface covering layer. The lighting system may include a data storage element comprising fixed control instructions for realising a light output being modulated in a way which accounts for the inhomogeneity of the surface covering layer, or alternatively such control instructions may be provided by a remote data storage device, e.g. a cloud storage device, to which the controller is communicatively coupled, or in real-time, e.g. through an optical system monitoring the luminous output distribution of the lighting system through the surface covering layer. The modulation may be to compensate for the inhomogeneous transmissivity. A controller controls the lighting assembly in accordance with these control instructions to thereby provide onto the surface covering layer a light pattern being specifically configured to account for the luminous inhomogeneity of the surface covering layer, and thereby more faithfully realise a desired light effect

By 'non-homogeneous light transmissivity' is meant a transmissivity which varies as a function of position across the surface covering layer. For instance, the surface covering layer may be a floor covering layer having a laminar construction, consisting of two opposing major surfaces. The transmissivity of the covering layer may vary as a function of position across the entity, along directions parallel with one or both of these major surfaces.

Transmissivity means the effectiveness of the entity in transmitting radiant energy. It may for instance refer to the fraction of incident electromagnetic power that is transmitted through the body (at a given location). Transmissivity may be understood throughout this application as synonymous with transmittance for instance.

By 'non-homogeneous intensity distribution' is meant a light output which varies in brightness or radiant energy or power as a function of position across for instance an

incident surface. The light output may additionally or alternatively vary in wavelength or spectral composition (i.e. colour) across the light output, for instance as a function of position across an incident surface.

In accordance with at least one set of embodiments, the light output may have
5 a non-homogeneous intensity distribution complementary to said non-homogeneous transmissivity to at least partially counter the non-homogeneous light transmissivity upon transmission of the light output through the surface covering layer. In accordance with these embodiments, the light output may act to reduce the inhomogeneity of light emitted from the surface covering layer after transmission through the surface covering layer. The
10 complementary pattern of light intensity enables a counteraction in the inhomogeneity and may achieve a substantially more homogeneous light output.

The light output may be a light output pattern featuring sharply defined regions of illumination with surrounding regions of non-illumination. In these cases, the above referenced light intensity distribution may be taken to refer to the distribution across
15 the illuminated regions of the pattern only. Rendering a light output pattern more homogeneous in its intensity distribution may refer to increasing homogeneity in the intensity distribution across its illuminated region(s).

The intensity of the light output (within illuminated regions) may in particular examples vary as a function of position across said light receiving surface of the surface
20 covering layer in an inverse or opposite manner to the variation of light transmissivity of the surface covering layer across said surface covering layer. Portions of the light output of higher intensity will thus fall incident onto regions of the surface covering layer of lower light transmissivity. Regions of lower light intensity within the light output will fall incident onto regions of higher transmissivity of the surface covering layer. The emitted light output
25 may thus be modulated to reciprocally complement the transmissivity pattern of the surface covering layer and thereby compensate for the non-uniform transmissivity to produce a resultant light output after transmission through the surface covering layer which is more homogeneous (across illuminated regions).

In accordance with a further set of embodiments, the light output may be
30 configured to reinforce the non-homogeneous light transmissivity to thereby amplify the inhomogeneity of light emitted from the surface covering layer after transmission through the surface covering layer. In these cases, the light output is modulated in a manner which takes account of the inhomogeneity in the transmissivity of the surface covering layer but which seeks not to counter it, but to amplify it. This may achieve interesting aesthetic effects by for

example enhancing the contrast or vividness of certain patterning already inherent in the surface covering layer.

In further examples, the light output may be configured to achieve any desired output light effect from the lighting system by appropriately modulating the light effect to take account of, or compensate for, the non-uniform transmissivity of the surface covering layer. In these examples, a desired output light pattern or effect may simply be superposed with a static modulation pattern being complementary to the transmissivity pattern of the surface covering layer. In this way, the desired light effect is pre-modulated in accordance with the known transmissivity pattern of the surface covering layer such that, upon transmission through the surface covering layer, the modulation is cancelled out by the inhomogeneous transmission properties of the surface covering layer, and the original desired output light effect is faithfully rendered.

In accordance with any embodiment, the light output generated by the lighting assembly may be a static light output or a dynamic light output. A dynamic light output enables creation of moving or changing light effects using the surface lighting system, for instance scrolling text or moving images.

In particular examples of any embodiment of the invention, the surface covering layer may have a non-homogeneous spectral transmissivity. In these cases, the light output may be further controlled to have a non-homogeneous spectral intensity distribution, based on the non-homogeneous spectral transmissivity. By spectral transmissivity is meant frequency-specific transmissivity, wherein the surface covering layer may exhibit a different transmissivity for different frequencies of light.

The non-homogeneous spectral intensity distribution may be complementary to the non-homogeneous spectral transmissivity to compensate for the spectral inhomogeneity of the surface covering layer. This may enable emission from the surface covering layer of a more spectrally homogeneous light output.

The non-homogeneous spectral transmissivity may arise due to colour patterning of the surface covering layer. The non-homogeneous spectral intensity distribution may manifest in a colour patterning of the light output. In examples, this may be a colour patterning reciprocal to that of the surface covering layer, being configured to be compensate for the colour patterning of the surface covering layer.

The lighting assembly may in examples comprise an array of independently dimmable light sources. The non-homogeneous spatial intensity distribution may be realised through selective dimming of the array of light sources.

In particular examples, each of said light sources may be or may comprise an LED light source.

In accordance with at least one set of embodiments, the surface lighting system may further comprise an ambient light level sensor operatively coupled with the controller, and wherein the controller is configured to vary a global intensity level of said light output pattern at least partly in dependence upon an output of said ambient light level sensor. In particular, a global intensity level of the light output may be reduced in response to lower ambient light levels, and may be increased in higher ambient light levels. This avoids the light being uncomfortably bright when ambient light levels are low, and improves visibility of the light output pattern when ambient light levels are high.

The lighting system may in examples further comprise a data communication interface for receiving control instructions for controlling the lighting assembly. The data communication interface may be operatively coupled with the data storage element and adapted to communicate received control instructions to the data storage element for storing. The data communication interface may be adapted to receive instructions via a local or remote area network, via an internet connection, or via any other wired or wireless communication medium. The data communication interface may provide a means for initially communicating the fixed control instructions to the lighting system, for instance during a commissioning process, or, additionally or alternatively, for updating the control instructions subsequent to initial installation and commissioning of the system, for instance after carrying out maintenance work such as replacement of the surface covering layer (e.g. a worn or dirty carpet layer).

In accordance with one or more embodiments, the controller may be further configured to receive one or more user input commands, and wherein the intensity distribution of the light output pattern is controlled at least partly in dependence upon said user input commands. The user input commands might relate for instance to calibration of the lighting system, for example enabling global position adjustments of the light output pattern on the incident surface of the surface covering layer. This would allow means for fine tuning the alignment of the light output pattern with the surface covering layer subsequent to installation of the lighting system.

The user input commands may additionally or alternatively relate to a global intensity of the light output pattern. The user input commands may in further examples enable any other adjustment or alteration to the light output pattern.

In order to realise a light output being configured to account for the specific non-homogeneous transmissivity of a given surface covering layer (to either counter it or otherwise), it may be necessary to determine the specific required light pattern and corresponding control instructions for each particular cover layer in advance.

5 In some cases, the transmissivity properties of the surface covering layer may be known in advance, in which case control instructions may be determined in advance based on these known properties and configured to realise a light pattern suitably modulated to account for any inhomogeneity, for instance modulated to counter or offset the inhomogeneity.

10 In further alternative cases, the particular transmissivity pattern of a surface covering layer may not be known in advance. In these cases, it may be necessary to ascertain these properties *in situ*, through on-site examination of the optical transmissivity of the surface covering layer after an initial provisional installation of the surface lighting system behind the surface covering layer, such as beneath a floor covering layer.

15 According to a second aspect of the invention, there is provided a method of commissioning a light-emitting surface covering system as described in any of the examples outlined above, comprising:

 controlling the lighting assembly to provide across said light receiving surface of the surface covering layer a homogeneous light output;

20 controlling an image capture means arranged in front of the surface covering layer, such as above a floor covering layer, to capture an image of a pattern of light transmitted through the surface covering layer from the lighting assembly;

 determining a spatial intensity distribution of said light pattern transmitted through the surface covering layer; and

25 determining control instructions for execution by the controller for controlling the lighting assembly to realise a light output being based on said determined spatial intensity distribution.

 In accordance with this approach, the intensity distribution properties of the generated light output are adapted based on observed transmission characteristics of the surface covering layer. The pattern of light emitted from the surface covering layer after transmission through the surface covering layer of an initially homogeneous light source provides an indication of the particular pattern of transmissivity embodied by the surface covering layer. Based upon this, the particular modulation of the light pattern and the

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corresponding control instructions necessary to account for the observed transmissivity pattern can be determined.

In particular examples, the control instructions may be determined so as to realise a light output pattern being configured so as to at least partially counter the non-homogeneous transmissivity of the surface covering layer upon transmission of the light output through the surface covering layer.

In particular, the control instructions may be determined to realise a light output pattern which varies as a function of position across said light receiving surface in an inverse or opposite manner to the variation of light transmissivity of the surface covering layer across said surface covering layer. In this way, inhomogeneity in the transmissivity may be substantially offset.

The control instructions may be determined externally, based on said captured image, and then communicated to the surface lighting system (for instance via a data communication interface, where such a unit is provided).

The surface covering layer may be a floor covering layer, which may by way of example comprise one or more carpet elements. Any other kind of floor covering, including for instance wood, vinyl or linoleum may also be used. In other words, the surface covering layer may be a floor covering element. In the context of this invention, a floor covering element is also simply referred to as a flooring element, which is to be understood as a finishing material for application over a floor surface to provide a walking surface. The flooring element may be a carpet flooring element, a PVC flooring element, or a laminate flooring element. A PVC flooring element is a flooring element that comprises (or is based on) polyvinyl chloride (PVC). A laminate flooring element is a flooring element that comprises (or is based on) laminate flooring tiles or panels, a laminate flooring tile or panel being a flooring product comprising a fused multi-layer structure.

The surface covering layer may also be a ceiling or wall covering layer, which may comprise a material selected from the group consisting of plasters and wallpapers.

Alternative surface covering layers may comprise a material selected from the group consisting of paint, ceramic, paper, wood, plastic, textile, and vinyl.

In accordance with one or more examples, the surface covering layer may comprise one or more shaped light exit windows. The windows may be regions of extreme high transmissivity, enabling escape of light with minimal attenuation. The light exit windows may be shaped to provide a decorative effect or alternatively to communicate information to observers. They may be shaped in the form of characters or words for

instance, or in the form of symbols such as direction arrows. The light exit windows may provide an additional aesthetic effect, further to the light effects created by the transmitted light output. The light exit windows may or may not be visible upon deactivation of the lighting assembly. Where the light exit windows are implemented at an uppermost (visible) surface of the surface covering layer, the windows may be visible, even when no light is being provided to the covering layer. Where, on the contrary, the light exit windows are implemented at a lower level of the covering layer (constructed for instance such that at least a thin layer of material is left covering the exit window), the windows may be invisible upon deactivation of the lighting assembly. For the avoidance of doubt, it is noted that in such embodiments the surface covering layer may be a layer stack in which the shaped light exit windows may be located in any layer of the layer stack.

According to a third aspect of the invention, there is provided a method of compensating a luminous inhomogeneity of a light-emitting surface covering system, the light-emitting surface covering system comprising:

a surface covering layer having a non-homogeneous light transmissivity, being a light transmissivity that varies as a function of position across the surface covering layer; and

a surface lighting system installed behind said surface covering layer, the surface lighting system comprising a lighting assembly for directing a light output onto a light receiving surface of the surface covering layer,

the method comprising the steps of:

controlling said lighting assembly in accordance with a fixed set of control instructions, the control instructions being for realising a light output having a non-homogeneous intensity distribution, being an intensity distribution that varies as a function of position across the light receiving surface of the surface covering layer, the intensity distribution being based on said non-homogeneous light transmissivity of the surface covering layer.

In particular examples, the non-homogeneous light intensity may be complementary to said non-homogeneous light transmissivity to at least partially counter the non-homogeneous light transmissivity upon transmission of said light output pattern through the surface covering layer.

In accordance with particular examples, the surface covering layer may have a non-homogeneous spectral transmissivity, being a spectral transmissivity that varies as a function of position across the surface covering layer. In these cases, the light output of the

lighting assembly may be further controlled to have a non-homogeneous spectral intensity distribution, being a spectral intensity distribution that varies as a function of position across the light receiving surface of the surface covering layer the spectral intensity distribution being based on the non-homogeneous spectral transmissivity of the surface covering layer. In
5 examples, the non-homogeneous intensity distribution of the light output provided by the lighting assembly may be complementary with the non-homogeneous spectral transmissivity of the surface covering layer. The phrases 'non-homogeneous spectral transmissivity' and 'non-homogeneous spectral intensity distribution' are to be interpreted as defined above.

By providing a light pattern having a spectral intensity distribution
10 complementary to the spectral inhomogeneity of the surface covering layer, this homogeneity may be at least partially countered or offset. In particular, this spectral inhomogeneity of the surface covering layer may manifest in a colour patterning of the surface covering layer. The light output may counter this with a complementary colour patterning, configured to realise a uniform colour output after transmission through the surface covering layer.

15 In alternative examples, the light pattern may have a spectral intensity distribution configured to reinforce the spectral inhomogeneity of the surface covering layer, for instance to amplify or increase the contrast or vividness of a colour patterning intrinsic in the covering layer. In these cases, the intensity distribution of the light output provided by the lighting assembly may substantially match or correspond to the non-homogeneous
20 transmissivity of the surface covering layer.

BRIEF DESCRIPTION OF THE DRAWINGS

Examples of the invention will now be described in detail with reference to the accompanying drawings, in which:

25 Fig. 1 schematically illustrates a first example floor lighting system for use in one or more embodiments of the invention;

Fig. 2 schematically illustrates the optical operation of an example floor lighting system for use in one or more embodiments of the invention;

Fig. 3 schematically illustrates an example lighting assembly as comprised by
30 one or more embodiments of the invention; and

Fig. 4 schematically depicts an example commissioning method for a floor lighting system in accordance with one or more embodiments of the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The invention provides a surface lighting system for installation behind a surface covering layer, such as beneath a floor covering layer, wherein the surface lighting system is configured to generate a light output for transmission through the surface covering layer having a spatial intensity distribution that is configured to improve homogeneity of a light output emitted through the surface covering layer. A lighting assembly is controlled in accordance with control instructions stored in a data storage element to generate a light output pattern having an intensity distribution being based on a non-homogeneous transmissivity of the surface covering layer. In particular examples, the intensity distribution may be configured to be complementary to the non-homogeneous transmissivity of the surface covering layer so as to at least partially counter the non-homogeneous transmissivity upon transmission through said surface covering layer.

In the remainder of this description, the invention is illustrated by means of examples wherein the surface lighting system is a floor lighting system, and wherein the surface covering layer is a floor covering layer. It should however be understood that the invention is equally applicable to surface lighting systems in the form of ceiling or wall lighting systems, wherein the surface covering element is either a ceiling or wall covering layer, such as a ceiling or wall covering layer that comprising a material selected from the group consisting of plasters and wallpapers.

Fig. 1 schematically illustrates a first example lighting system 6 in accordance with one or more embodiments of the invention. The lighting system comprises a lighting assembly 44 operatively coupled to a controller 46, the controller being adapted to control the lighting assembly in accordance with fixed control instructions. The control instructions may be stored in a data storage element 48 communicatively coupled with the controller or alternatively may be retrieved from a remote data storage element, e.g. a cloud-based data storage element, or in real-time by an optical feedback loop as will be explained in further detail below. The data storage element 48 may be integral to the controller. The floor lighting system 6 is installed beneath a floor covering layer 12 having a non-homogeneous light transmissivity. This is schematically illustrated in Fig. 1 by three regions 16, 18, 20 of relative high light transmissivity surrounded by a broader encompassing region 24 of relative low light transmissivity (relative to the first regions 16, 18, 20). The floor lighting system 6 and the floor covering layer together provide a light emitting flooring system 8.

The controller may for example comprise or employ one or more processors or microprocessors which may be programmed using software (e.g. microcode) to perform the

required functions. A controller may however be implemented with or without employing a processor, and also may be implemented as a combination of dedicated hardware to perform some functions and a processor (e.g. one or more programmed microprocessors and associated circuitry) to perform other functions.

5 The data storage element may by way of example comprise or be a volatile or non-volatile computer memory such as RAM, PROM, EPROM, and EEPROM, Flash and so on. Other suitable data storage elements, e.g. a magnetic, solid state or optical disk are equally feasible and will be immediately apparent to the skilled person.

10 The lighting assembly 44 of the floor lighting system 6 is arranged in optical communication with the floor covering layer 12 and has a light output surface 50 operable to direct onto a light receiving surface 52 of the floor covering layer 12 a light output pattern having a configurable spatial intensity distribution. The light output pattern may be static or may be non-static. The light output pattern may change dynamically based on a pre-programmed routine, or based on one or more input parameters for instance.

15 The controller 46 controls the lighting assembly 44 in accordance with the fixed control instructions stored in the data storage element 48. The control instructions are configured for realising a light output pattern having an intensity distribution complementary with the non-homogeneous transmissivity of the flooring element 12 so as to at least partially counter said non-homogenous transmissivity.

20 This is illustrated in Fig. 1 in which a schematic representation of a cross-section 54 of the light output pattern intensity distribution is shown part way between the lighting assembly 44 and the floor covering layer 12. The 'cross-section' 54 schematically represents the spatial intensity distribution of the light output across a planar cross-sectional region extending parallel with the light receiving surface 52 of the floor covering layer 12.

25 The intensity varies spatially as a function of position across the planar cross-section, and in particular comprises three regions of relative low light intensity 26, 28, 30 surrounded by a broader encompassing region 34 of relative high light intensity (relative to the first regions 26, 28, 30). It is assumed that the light intensity distribution remains uniform in directions perpendicular to the cross-sectional plane 54 (such that the cross-sectional intensity

30 distribution is the substantially same at all points along the light path between the lighting assembly and the floor covering layer).

 The light output pattern is configured such that upon projection onto the light receiving surface 52 of the floor covering layer 12, the three regions of relative low light intensity 26, 28, 30 map onto the three regions of relative high light transmissivity 16, 18, 20

of the floor covering layer. Likewise, the broader encompassing region of relative high light intensity 34 is configured to map onto the broader encompassing region of relative low light transmissivity 24 of the floor covering layer.

The light output pattern emitted by the lighting assembly 44 is hence
5 configured to exhibit across the light receiving surface 52 of the floor covering layer 12 a non-homogeneous light intensity distribution which varies as a function of position across said surface 52 in an inverse or opposite manner to the variation of the light transmissivity across the covering layer. Regions of higher light transmissivity 16, 18, 20 of the floor
10 covering layer are aligned so as to engage optically with regions of relatively lower light intensity 26, 28, 30 of the light output pattern. In this way the intensity distribution of the light output pattern acts to compensate or counter the inhomogeneity in light transmissivity of the floor covering layer, by ensuring that proportionately less light reaches regions of high transmissivity and proportionately more light reaches regions of lower transmissivity.

This effect is illustrated schematically in Fig. 2 which shows in greater detail
15 the light output pattern of Fig. 1 (as represented by the cross-section 54 through its intensity distribution) and the floor covering layer 12 onto which the pattern is being projected. The black arrows in Fig. 2 illustrate the intensity of light being propagated at different spatial locations, with larger arrows indicating light having a greater relative intensity or power, and smaller arrows indicating light of a lower relative intensity or power. Thus light of greater
20 intensity is shown being propagated at the high intensity region 34 of the light output pattern and light of lesser intensity at the low intensity regions 26, 28, 30.

This inhomogeneous light output pattern is received at the light receiving surface 52 of the floor covering layer 12. Due to the complementarity described above between the intensity distribution of the light output pattern and the transmissivity pattern of
25 the floor covering layer 12, the regions of lower light intensity 26, 28, 30 of the light output pattern fall incident at the floor covering layer 12 exactly mapping onto the three relatively higher regions of light transmissivity 16, 18, 20 of the floor covering layer. Similarly, the region of higher light intensity 34 arrives at the floor covering layer incident exactly across the region of relatively lower light transmissivity 24.

30 The floor covering layer 12 then optically processes the light in accordance with its inhomogeneous light transmissivity, resulting in a further modulation of the light output. Due to the complementarity between the intensity distribution of the light output and the transmissivity pattern of the covering layer 12, this modulation effectively counters or offsets the inhomogeneity in light intensity imparted by the lighting assembly 44 to the light

output pattern; regions of higher light intensity 26, 28, 30 are attenuated to a greater extent by the floor covering layer and the region of lower intensity 34 is attenuated to a lesser extent.

This is illustrated schematically in Fig. 2, where upon transmission through the floor covering layer 12, the intensity of the light is modulated such as to become substantially even across the extent of the flooring surface. Consequently, a substantially homogeneous light output results, despite the inhomogeneity in the transmissivity of the floor covering layer 12.

Although in the particular example of Figs. 1 and 2, the lighting system is configured to generate a light output being modulated to counter the inhomogeneity in transmissivity of the floor covering layer 12, in further examples, the light output may be configured to account the inhomogeneity in a different way. For example, the light output may be configured to enhance or amplify the inhomogeneity. This may achieve interesting aesthetic effects, for instance enhancing the contrast or vividness of the intrinsic patterning of the covering layer by virtue of which the inhomogeneous transmissivity arises.

Reinforcement of the inhomogeneous transmissivity may be achieved simply by inverting the principles applied in the example of Figs. 1 and 2. A light output may be created having regions of high intensity shaped and aligned so as to fall incident onto regions of high transmissivity of the floor covering layer, and vice versa. In this way the inhomogeneity is amplified.

More broadly, the light output may be configured, not just to create a realise uniform light output from the lighting system, but to create any desired light pattern, wherein the light pattern has been pre-modulated to account of the non-uniform transmissivity of the floor covering layer. In these cases, the same principles of the example of Figs. 1 and 2 may be applied. In creating the light output for projection onto the covering layer 12, the desired final output light pattern or effect may simply be superposed or overlaid with an intensity modulation pattern which is complementary (in a reciprocal manner) to the transmissivity pattern of the floor covering layer. Upon transmission through the covering layer, the layer modulates the light output a second time, in an opposite manner to the pre-applied modulation pattern. This thereby renders a resultant light output which matches the originally desired output light effect.

The lighting assembly 44 is operable to generate a light output pattern having any arbitrary spatial intensity distribution (within certain resolution constraints intrinsic to the lighting assembly). In accordance with at least one set of embodiments, the lighting assembly may comprise an array of individually dimmable light sources. An example is illustrated

schematically in Fig. 3. The exterior of the lighting assembly is illustrated at the top part of the figure. In the bottom part of the figure is shown an array of LED light sources 62 which is provided mounted within the interior of the lighting assembly, for example coupled to a base surface of the lighting assembly. The array of light sources is mounted collectively to a PCB 64, which in turn may be mounted to a base surface within the lighting assembly. The array of LEDs is in any case arranged within the lighting assembly in optical communication with a light exit surface 50 of the lighting assembly. The light exit surface may comprise a transparent or translucent window for example. The light exit surface may in further non-limiting examples be an opening comprising no material covering.

Each of the LEDs 62 may be individually dimmable. By this is meant that each LED may have independently controllable light output intensity. By appropriately controlling the output intensities of the array of LEDs, a light output may be generated collectively from the array having any arbitrary light intensity distribution (within the particular resolution constraints of the array; a higher density array will be capable of a light output pattern of higher resolution.

Each LED 62 may also have an independently controllable light output colour. This may enable a light output to be generated from the array having a configurable spectral intensity distribution or spectral composition (e.g. a particular colour patterning). The LED light sources may each comprise an RGB LED for instance.

Although in the particular example of Fig. 3, LED light sources 62 are shown, in further examples any other suitable light sources may also be used, including but not limited to other solid state light sources, fluorescent light sources and incandescent light sources.

Although in the example of Fig. 3, the light sources 62 are shown spatially separated from one another, in further examples, the light sources may be contiguous or approximately contiguous with one another. The light sources may function as pixel elements within a pixelated array for example.

As noted above, the lighting assembly 44 is controlled in accordance with control instructions to realise the light output pattern 54 directed onto the floor covering layer 12. The control instructions are stored in the data storage element 48 and executed by the controller 46.

In accordance with a first set of embodiments, the floor lighting system 6 may be provided with a data storage element 48 having control pre-programmed control instructions loaded onto the storage element in advance. The lighting system may for

example be specially designed or adapted for operation with a particular variety or model of floor covering layer 12. In this case, the particular light pattern required to counter the inhomogeneity of the floor covering layer may be determined in advance and the control instructions necessary to realise that light pattern pre-programmed and stored on the data storage element 48 during production of the lighting system. So long as the lighting system continues to be used only in association with said particular floor covering layer, the control instructions need not be altered.

In accordance with at least a further set of embodiments, the floor lighting system 6 may be adapted such that the control instructions stored on the data storage element 48 may be changed. This would increase operational flexibility of the lighting system, since it would enable amendment or alternation of any pre-programmed instructions loaded in advance onto the data storage element 48, and/or enable deferment of the storage of any initial control instructions until after production and/or installation of the system 6. In the latter case the instructions may then be selected and/or devised subsequently, in dependence upon the particular floor covering layer with which the system is to be used.

In accordance with this further set of embodiments, the floor lighting system 6 may further comprise a data communication interface, communicatively coupled with the controller 46 and adapted to receive control instructions for controlling the lighting assembly. Such an embodiment is illustrated in Fig. 1, wherein a data communication interface 82 is shown communicatively coupled with the controller 46. The data communication interface may be adapted to connect with one or more remote servers or computers via for instance a local or remote area network connection or via an Internet connection. Any other form of wired or wireless communication medium might also be used.

In accordance with one or more embodiments, the controller 46 may be further configured to receive one or more user input commands for altering operation of the floor lighting system 6. The user input commands may in examples at least partly inform the intensity distribution of the light output pattern generated by the lighting assembly 44. For example the user input commands might in examples facilitate spatial calibration or alignment of the light output pattern with the floor covering layer 12. This may in examples comprise informing global positional adjustments of the light output pattern on the light receiving surface 52 of the floor covering layer 12. The user input commands may additionally or alternatively be used to adjust or alter any other aspect or property of the light output pattern, including for example the intensity distribution itself (either on a global or local level).

Where the floor lighting system 6 further comprises a data communication interface (as discussed above), the data communication interface may be configured to receive the user input commands. Alternatively, the controller 46 itself may be configured to receive such commands. The commands may be communicated in examples via a suitable
5 local or wide area network connection, through an Internet connection or through any other communication medium, for instance Bluetooth, infrared or near field communication.

The floor lighting system may in accordance with one or more embodiments further comprise an ambient light level sensor 84 operatively coupled with the controller 46. Such a sensor 84 is shown in Fig.1, operatively coupled with the controller. Although in Fig.
10 1 (which shows the functional relationship with the controller only), the ambient light level sensor 84 is shown beneath the level of the floor covering layer 12, in other embodiments, the light level sensor may be positioned above the level of the flooring layer, such that ambient light is better able reach the sensing elements of the sensor. Where the light level sensor is positioned below the level of the floor covering layer, a process of calibration may be
15 performed in order to enable the sensor to accurately measure ambient light levels above the level of the covering layer.

The controller may be configured to alter properties of the light output pattern in dependence upon a signal output of the sensor. For example, the controller may adjust a global intensity level of the light output pattern in dependence upon an ambient light level.
20 Where ambient light levels are low, a global intensity level may be reduced to avoid eye strain due to overly bright light (or to reduce power consumption). Where ambient light levels are high(er), a global intensity level may be increased to ensure adequate visibility of the light output emitted through the floor covering layer 12. In this manner, the sensor may implement an optical feedback loop based on which the control instructions for the controller
25 are defined.

In accordance with any embodiment of the invention, the light output pattern may be controlled to have a non-homogeneous spectral intensity distribution based on a non-homogeneous spectral transmissivity of the floor covering layer. The spectral intensity distribution may in examples be for countering a non-homogeneous spectral transmissivity of
30 the floor covering layer 12. For example, the floor covering layer 12 may feature coloured patterning, resulting in differing attenuation of transmitted light depending upon the colour (or the frequency) of the light. This may result in colour-patterned light output. The light output projected onto the floor covering layer may be provided having an inherent colour

patterning, configured so as to take account of the patterning of the covering layer, to either offset it or to amplify it.

In accordance with one set of examples, the light output pattern may be generated using the lighting assembly 44 having a non-homogeneous spectral intensity distribution complementary to the spectral transmissivity pattern of the covering layer 12 so as to compensate or counter the spectral non-homogeneity of said covering layer 12. Here, regions of the covering layer of a first particular colour may be provided with light of a second, different colour, being selected so as to combine with the first colour to produce a third colour. Every colour region of the floor covering layer may be provided with light of a respective complementary colour having a spectral transmissivity configured to realise said common third colour. In this way, a chromatic uniformity of light output may be achieved for light transmitted through the floor covering layer.

In accordance with a further aspect of the invention, the floor lighting system 6 may be provided in combination with the floor covering layer 12, thereby providing a fully self-contained light-emitting flooring system 8. The floor covering layer 12 may be any variety of light transmissive flooring element, and may, by way of non-limiting example, comprise a carpet layer, linoleum, vinyl, wood, or any other suitable flooring material.

The floor covering layer 12 may in particular examples comprise dedicated light exit windows to allow escape or passage of light with minimal attenuation. The windows may be specially shaped to provide a decorative effect or to communicate information. The light exit windows may be regions of extreme high light transmissivity, or may be openings through the floor covering layer. The light exit windows may in examples be shaped to communicate worded messages, or to communicate information via symbols or other pictorial representation (e.g. arrows indicating a direction of travel).

The light exit windows are excluded from the transmissivity compensation scheme of the remainder of the arrangement. Where the floor covering layer 12 comprises light exit windows, the light output pattern is not configured to compensate for the high transmissivity of the window regions, since the windows are intended to appear to observers as regions of relative high light output intensity. In particular examples, the controller may be configured to control the light output pattern so as to direct onto each light exit window light of the same or similar intensity, such that the apparent brightness of each window to an observer is approximately uniform.

In order to realise from embodiments of the floor lighting system 6 a light output pattern being configured to counter the specific non-homogeneous transmissivity of a

given floor covering layer 12, it may be necessary to determine the specific required light pattern and corresponding control instructions for each particular cover layer in advance. In some cases, the transmittance properties of the floor covering layer may be known in advance, in which case the required light output pattern and control instructions may be
5 determined based on these known properties so as to counter or offset any inhomogeneity.

The specific control instructions may be pre-loaded onto the data storage element 48 of a given floor lighting system 6 and the system then distributed jointly with the floor covering layer 12 for which it has been designed, the two providing a self-contained light-emitting flooring system 8. Alternatively, a particular set of control instructions may be
10 coded in advance for a specific model or variety of known floor covering layer, and may be communicated or downloaded (for instance at an additional cost to the consumer) separately for installation onto the data storage element 48.

In some cases however, the particular transmissivity pattern of a floor covering layer 12 may not be known in advance. In these cases, it may be necessary to
15 ascertain these properties *in situ*, through on-site examination of the optical transmissivity after an initial provisional installation of the floor lighting system 6 beneath the floor covering layer. After analysis of the transmissivity properties, an appropriate light output pattern and corresponding control instructions may be determined and subsequently communicated or downloaded onto the data storage element 48.

Accordingly, examples in accordance with a further aspect of the invention
20 provide a method of commissioning a floor lighting system 6 in which control instructions are determined for controlling the lighting assembly 44 to generate a light output pattern to counter the non-homogeneous light transmissivity of the floor covering layer 12. The method comprises examining the optical transmittance properties of the floor covering layer under
25 homogeneous illumination and, on the basis of the results, determining a particular complementary light output pattern, and corresponding control instructions, adapted to counter any inhomogeneity.

A first stage of the method is illustrated schematically in Fig. 4. A light transmissive floor covering layer 12 is installed or at least provisionally mounted in optical
30 communication with the lighting assembly 44 of a floor lighting system 6. The lighting assembly is controlled by a controller 46 to direct a (at least substantially) homogeneous light output through a light receiving surface 52 of the floor covering layer. The controller may for example be operable in a dedicated 'commissioning' mode, for which a dedicated set of

control instructions are internally stored which cause the controller to generate a homogeneous light output from the lighting assembly 44.

The generated homogeneous light output is transmitted through the body of the floor covering layer 12 and modulated by the non-homogeneous light transmissivity of the layer. This non-homogeneous light transmissivity is illustrated schematically in Fig. 4 by
5 three (relative) higher light transmissivity regions 16, 18, 20, surrounded by an encompassing region of lower light transmissivity 24.

Light transmitted through the floor covering layer 12 is differently attenuated by the different regions of the layer, resulting in a non-homogeneous light output being
10 emitted from the surface of the layer. This is illustrated schematically by the black arrows, which indicate light propagation; larger arrows denoting light of greater light intensity or power and smaller arrows denoting light of lower intensity or power.

An image capture means 72 (a camera in the example shown in Fig.4) is arranged above the floor covering layer 12 with the floor covering layer within its field of
15 view. Upon activation of the lighting assembly 44 and transmission of light through the covering layer, the camera 52 is controlled to capture an image of the light output pattern emitted from the surface of the covering layer. The camera may in examples be operatively coupled with, and controlled by, the controller 46, or alternatively may be controlled by a different, external, control means.

20 The captured image is then analysed to determine an intensity distribution pattern of the light output (i.e. to derive a function or representation of the variation of intensity of the light output as a function of position across the surface of the floor covering layer). This analysis may be performed by the controller 46 of the lighting system 6 or may alternatively be performed by an external processing means, for instance a suitable external
25 computer.

Based on the derived spatial intensity distribution, the transmissivity pattern of the floor covering layer 12 may be determined. Since the light source generated by the lighting assembly 44 is assumed to be homogeneous, any inhomogeneity in the transmitted light output may be attributed to inhomogeneity in the transmissivity of the floor covering
30 layer. In particular, in accordance with at least one set of embodiments, the non-homogeneous light transmissivity of the floor covering layer may be assumed to be proportionate to the spatial intensity variation of the captured light output (since regions of higher light output will be caused by transmission of light through regions of higher light transmissivity).

Based on the captured light output, a particular light output pattern having a non-homogeneous light intensity distribution complementary with the non-homogeneous light transmissivity of the floor covering layer 12 may be determined and the corresponding control instructions for realising this light pattern generated. In particular, a light output
5 pattern may be devised having a spatial intensity distribution which, across its perpendicular planar cross-section, represents an inverse of the spatial intensity distribution of the captured light output. Since (as explained above) this distribution is reflective of the transmissivity pattern of the floor covering layer 12, by generating a light output pattern having an inverse variation in light intensity as a function of projected position across the covering layer 12, the
10 light pattern will function to counter or offset the variations in the covering layer transmissivity. In particular, spatial regions of the floor covering layer having a higher light transmissivity will, when the devised light output is appropriately aligned with the mask layer, be provided with regions of the light output having a lower light intensity.

The method of Fig. 4 may hence be employed to generate control instructions
15 for retrospective inclusion within a floor lighting system 6 which has already been at least provisionally installed.

Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not
20 exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. A light-emitting surface covering system (8), comprising:
 - a surface lighting system (6), and
 - a surface covering layer (12) having a light transmissivity that varies as a function of position across the surface covering layer (12),
- 5 wherein the surface lighting system (6) comprises:
 - a lighting assembly (44) for directing a light output onto a light receiving surface (52) of the surface covering layer (12), the light output having a configurable intensity distribution; and
 - a controller (46) adapted to control the lighting assembly (44) in response to
- 10 control instructions for controlling the lighting assembly (44), the control instructions being for realising a light output having an intensity distribution that varies as a function of position across the light receiving surface (52) of the surface covering layer (12), and
 - wherein the intensity distribution of the light output provided by the lighting assembly (44) is complementary to the light transmissivity of the surface covering layer (12)
- 15 to at least partially counter the light transmissivity upon transmission of the light output through the surface covering layer (12).
2. The light-emitting surface covering system (8) as claimed in claim 1, wherein the intensity distribution of the light output provided by the lighting assembly (44) is
- 20 complementary to the light transmissivity of the surface covering layer (12) to reduce an inhomogeneity of light emitted from the surface covering layer (12) after transmission through the surface covering layer (12).
3. The light-emitting surface covering system (8) as claimed in claim 1, wherein
- 25 the surface lighting system (6) further comprises a data storage element (48) for storing the control instructions.
4. The light-emitting surface covering system (8) as claimed in claim 1, wherein the intensity distribution of the light output provided by the lighting assembly (44) varies as a

function of position across the light receiving surface (52) of the surface covering layer (12) in an opposite manner to the variation of the light transmissivity of the surface covering layer (12) across the surface covering layer (12).

5 5. The light-emitting surface covering system (8) as claimed in claim 1, wherein the intensity distribution of the light output provided by the lighting assembly (44) is configured to reinforce the light transmissivity of the surface covering layer (12) and thereby amplify an inhomogeneity of light emitted from the surface covering layer (12) after transmission through the surface covering layer (12).

10

6. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the surface covering layer (12) has a spectral transmissivity that varies as a function of position across the surface covering layer (12), and wherein the light output provided by the lighting assembly (44) is further controlled to have a spectral intensity
15 distribution that varies as a function of position across the light receiving surface (52) of the surface covering layer (12) based on the spectral transmissivity of the surface covering layer (12), and optionally wherein the spectral intensity distribution of the light output provided by the lighting assembly (44) is configured to reduce a spectral inhomogeneity of light emitted from the surface covering layer (12) after transmission through the surface covering layer
20 (12).

7. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the lighting assembly (44) comprises an array of independently dimmable light sources (62), and optionally wherein each of said light sources comprises an LED.

25

8. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the surface lighting system (6) further comprises an ambient light level sensor operatively coupled with the controller (46), and wherein the controller (46) is configured to vary a global intensity level of the light output provided by the lighting assembly (44) at least
30 partly in dependence upon an output of the ambient light level sensor.

9. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the surface lighting system (6) further comprises a data communication interface for receiving control instructions for controlling the lighting assembly (44).

10. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the controller (46) is further configured to receive one or more user input commands, and wherein the intensity distribution of the light output provided by the lighting assembly (44) is controlled at least partly in dependence upon the user input commands.

11. The light-emitting surface covering system (8) as claimed in any preceding claim, wherein the light-emitting surface covering system (8) is a light-emitting flooring system (8), and wherein the surface covering layer (12) is a floor covering layer (12).

10

12. A method of commissioning a light-emitting surface covering system (8) as defined in any preceding claim, wherein the method comprises the steps of:

controlling the lighting assembly (44) to provide a homogeneous light output across the light receiving surface (52) of the surface covering layer (12);

15 controlling an image capture means (72) arranged in front of the surface covering layer (12) to capture an image of a pattern of light transmitted through the surface covering layer (12) from the lighting assembly (44);

determining a spatial intensity distribution of the pattern of light transmitted through the surface covering layer (12); and

20 determining control instructions for execution by the controller (46) for controlling the lighting assembly (44) to, based on the determined spatial intensity distribution, realise a light output having an intensity distribution that varies as a function of position across the light receiving surface (52) of the surface covering layer (12), the intensity distribution of the light output provided by the lighting assembly (44) being
25 complementary to the light transmissivity of the surface covering layer (12) to at least partially counter the light transmissivity upon transmission of the light output through the surface covering layer (12).

13. A method as claimed in claim 12, wherein the control instructions are
30 determined to realise a light output which varies as a function of position across the light receiving surface (52) of the surface covering layer (12) in an opposite manner to the variation of light transmissivity of the surface covering layer (12) across the surface covering layer (12).

14. A method of modifying a luminous inhomogeneity of a light-emitting surface covering system (8), wherein the light-emitting surface covering system (8) comprises:
a surface covering layer (12) having a light transmissivity that varies as a function of position across the surface covering layer (12); and
5 a surface lighting system (6) installed behind the surface covering layer (12), the surface lighting system (6) comprising a lighting assembly (44) for directing a light output onto a light receiving surface (52) of the surface covering layer (12),
and wherein the method comprises the steps of:
controlling the lighting assembly (44) in accordance with a fixed set of control
10 instructions, the control instructions being for realising a light output having an intensity distribution that varies as a function of position across the light receiving surface (52) of the surface covering layer (12), the intensity distribution being based upon the light transmissivity of the surface covering layer (12) upon transmission of the light output through the surface covering layer (12).
- 15
15. A method as claimed in claim 14, wherein the surface covering layer (12) has a spectral transmissivity that varies as a function of position across the surface covering layer (12), and wherein the light output of the lighting assembly (44) is further controlled to have a spectral intensity distribution that varies as a function of position across the light receiving
20 surface (52) of the surface covering layer (12), the spectral intensity distribution being based on the spectral transmissivity of the surface covering layer (12), and optionally wherein the spectral intensity distribution is configured to reduce a spectral inhomogeneity of light emitted from the surface covering layer (12) after transmission through the surface covering layer (12).

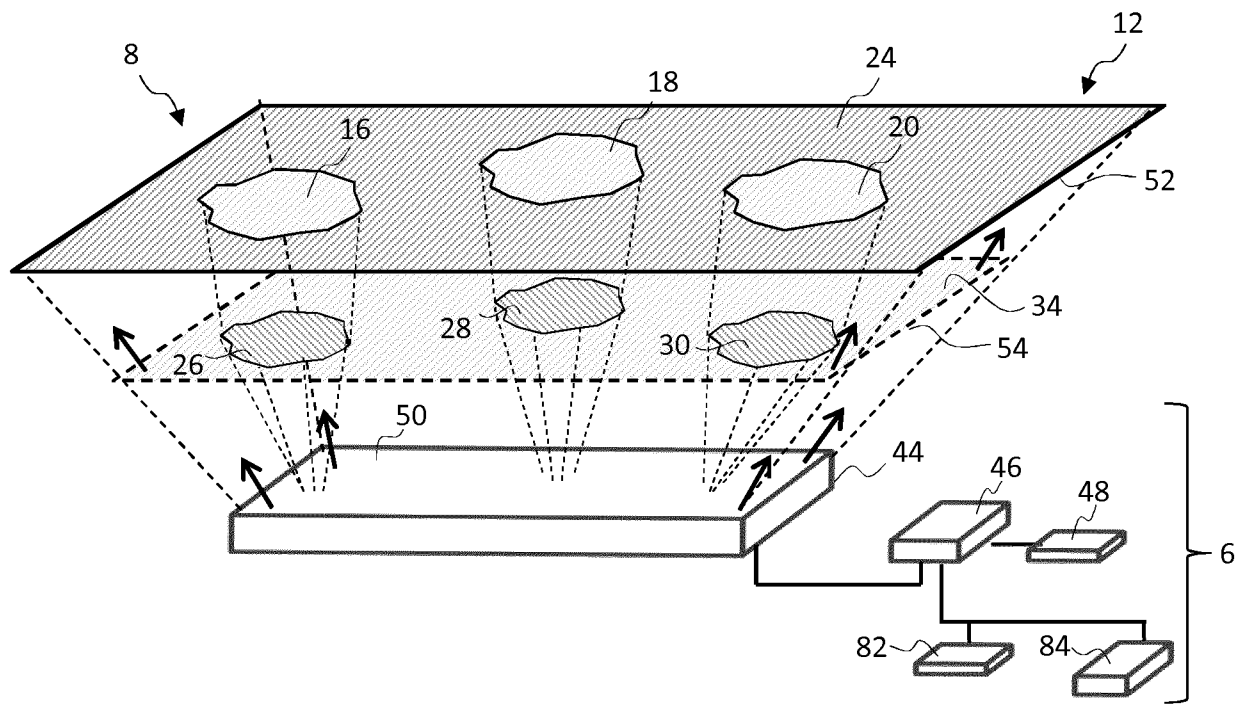
$1/2$ 

FIG. 1

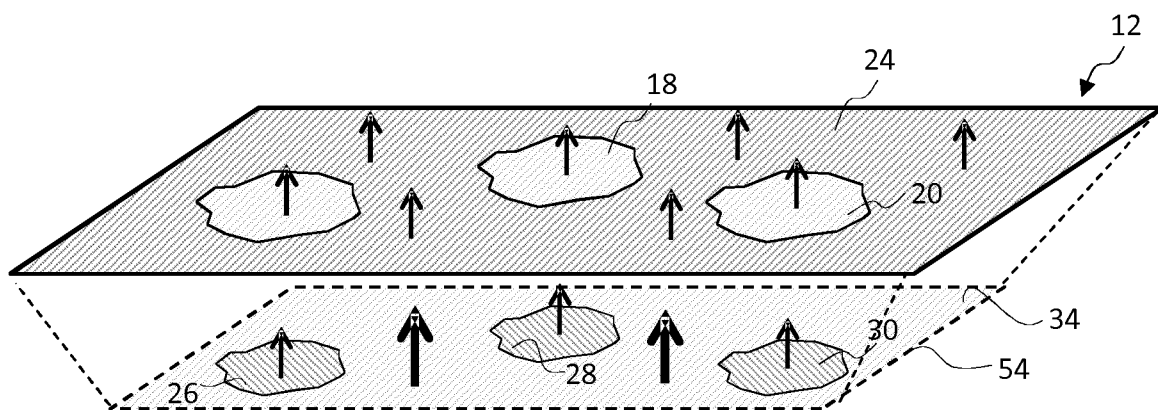


FIG. 2

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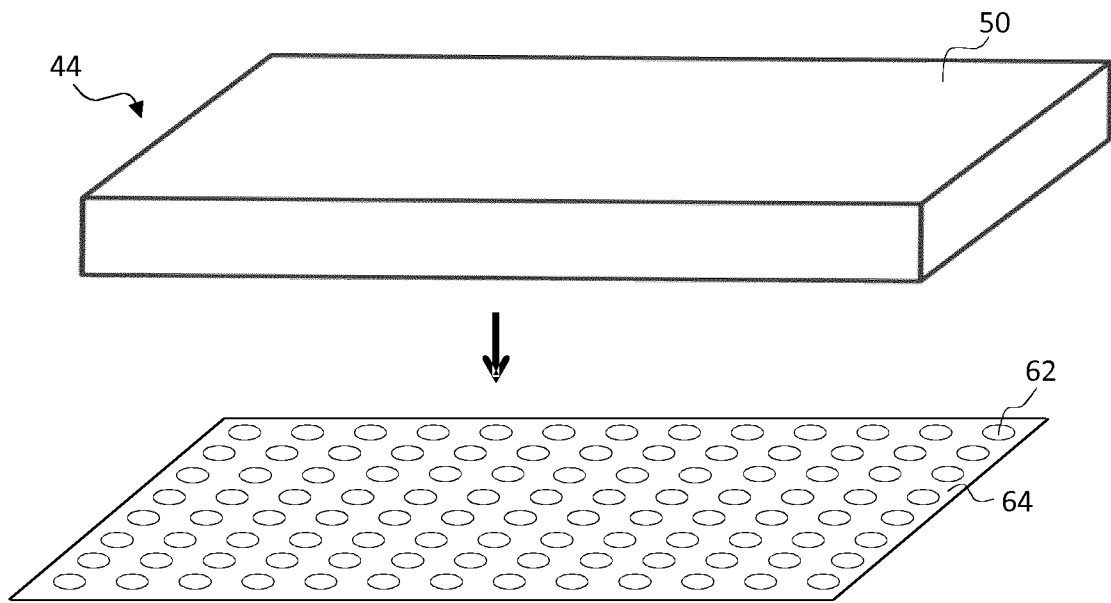


FIG. 3

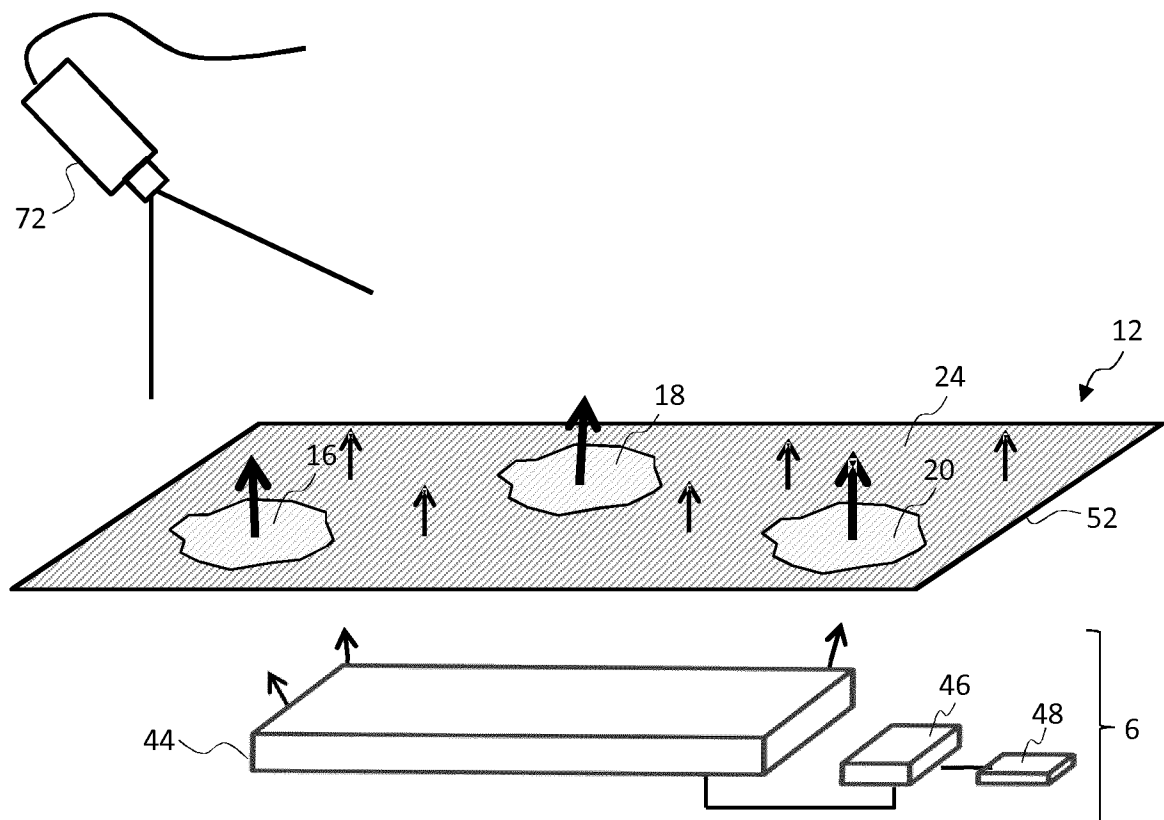


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/052924

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	F21S8/02 F21V33/00	F21V23/04 F21S10/00 G09F13/04 E04F15/00
ADD.	F21Y115/10	F21Y105/10
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) F21S F21V F21Y G09F E04F		
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		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 1 571 640 A2 (VILAGRASA S A [ES]) 7 September 2005 (2005-09-07) paragraph [0011] figure 7	1,2,4,7, 8,14,15 12,13
X	----- WO 2016/046364 A1 (TARKETT GDL [LU]) 31 March 2016 (2016-03-31) paragraphs [0026], [0031] - [0033], [0044] figures 1, 3, 6-8, 13	1,3, 5-11,14, 15
X	----- FR 3 004 204 A1 (TARKETT GDL SA [LU]) 10 October 2014 (2014-10-10) figures 1-4 ----- -/-	1,3,5-11
☒ 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 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 5 March 2018		Date of mailing of the international search report 13/03/2018
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Allen, Katie

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2018/052924

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No

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