

Description

Background of the invention

The present invention relates, in general, to an artificial light source device, and in more detail, to one in which the light rays from a light source lamp are converted to parallel light rays by means of a parabola reflection mirror and the parallel light rays are guided into an optical conductor rod. Furthermore the light rays coming from the optical rod are then guided into the optical conductor cable and the light rays coming from the optical conductor cable are then employed as a light source. Such a device has been described in EP—A—0.115.296, which document falls under Article 54(3) Epc (See also Fig. 1 of this document). In the device according to the invention, the light-receiving edge of the optical conductor cable is inclined in relation to the direction of the light rays' propagation. In addition to that, a filtering film capable of letting a pre-selected part of the light pass through the light-receiving edge surface and of reflecting other pre-selected portions of the light thereon, is provided in this proposed device. In such a manner, a part of the light is separated from the rest by means of a filtering film.

In general, it is possible to illuminate any place through the use of an electric lamp. However, in the case of illuminating in an explosive atmosphere or in water, there necessarily exists a danger of explosion or electric leakage. For this reason, the electric instrument to be used in such places has to be of an explosion-proof type or a water-proof type. However in the past, such an explosion-proof or water-proof instrument was heavy and expensive when completed, and it was also impossible to manufacture such completely explosion-proof or water-proof instruments as made possible by this new device.

Furthermore the present applicant has previously proposed a light compound reaction device for nurturing chlorella or the like, an intensive cultivation device for cultivating plants in atmosphere containing carbon dioxide (carbonic acid gas). In such devices, the light rays are necessary for creating a light compound reaction. In order to emit the necessary light rays for achieving its purpose, it needs to have a large number of small spotlight sources without emitting any heat and ultraviolet rays. In order to obtain the light source as mentioned above, the present applicant has previously proposed various methods and apparatuses in which solar rays are focused by a lens or the like and guided into an optical conductor cable consisting of a large number of optical fibers, and the solar rays are further guided through the optical conductor cable into the light compound reaction device of the chlorella nurturing device, the intensive plant cultivation device and the light rays emitted from the optical fiber are employed as a spotlight source.

However, if the light compound reaction device is effective even in the night time, only artificial

light rays are employed instead of solar rays as the main light source. In such a case, the light rays from the artificial light source lamp are guided into the optical conductor cable and further guided through the optical conductor cable into the light compound reaction device. In such a device it is necessary to switch alternately the source of the solar rays and the source of the artificial light rays in order to employ them in an alternating way. On some occasions it is necessary to use the solar rays and the artificial light rays from both of the light ray sources at the very same time.

In an artificial light source device as described above, the light rays from an artificial light source lamp are converted to parallel light rays. The parallel light rays are guided into an optical conductor rod and are further guided through it into another optical conductor cable. When the light rays from the artificial light source lamp are guided through the optical conductor rod into the optical conductor cable of the device according to the invention, the heat rays and the ultraviolet rays among the light rays coming from the artificial light source by means of the optical conductor rod are reflected, and further, the light rays or visible rays can be effectively guided into the optical conductor cable.

Summary of the invention

It is the primary object of the present invention to provide an artificial light source device which is an improvement over previous devices.

It is another object of the present invention to provide an artificial light source in which a pre-selected light component, for instance ultraviolet rays, is prevented from being guided into an optical conductor cable.

It is another object of the present invention to provide an artificial light source in which more high-quality light components, for instance visible rays, can be guided into an optical conductor cable.

These objects are solved with a light source device as specified in claim 1.

Brief description of the drawings

Fig. 1 is a cross-sectional view for explaining the construction of an embodiment of the artificial light source device previously proposed by the present applicant. (See EP—A—0.115.296).

Fig's 2 and 3 are cross-sectional views for explaining the construction of the first and second embodiments according to the present invention.

Description of the preferred embodiments

Fig. 1 is a cross-sectional view showing an embodiment of the artificial light source device previously proposed by the present applicant. In Fig. 1, 1 is an artificial light source lamp, 2 is a reflection mirror i.e. a parabola reflection mirror for converting light rays from the artificial light source lamp 1 to parallel light rays and for reflecting thereon, 3 is an optical conductor rod for receiving the parallel light rays from the

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reflection mirror 2, and 4 is an optical conductor cable consisting of a large number of optical fibers 4₁, 4₂, etc.

As shown in Fig. 1, the light rays from the artificial light source lamp 1 are converted to parallel light rays. The parallel light rays are initially guided into the optical conductor rod 3, and then further guided through the optical conductor rod 3 into the optical conductor cable 4. Furthermore, when the light rays from the artificial light source lamp 1 are guided through the optical conductor rod into the optical conductor cable in such a manner, the heat rays and the ultraviolet rays are among the light rays from the artificial light source, and the light rays can be effectively guided into the optical conductor cable.

However, in an artificial light source according to the present invention, pre-selected light components, for instance ultraviolet rays, are prevented from being guided into the optical conductor cable effectively and as a result more high-quality light components, for instance visible rays, can be guided into the optical conductor cable.

Fig. 2 is a cross-sectional view for explaining an embodiment of the present invention. In Fig. 2, the same reference numeral as Fig. 1 is attached to the part performing the same action as that of Fig. 1. In the present invention, the light-receiving edge of the optical conductor cable 4 is slightly inclined in relation to the direction of the propagation of the light rays and a filter 5, for instance a film 5 made by evaporating gold, capable of letting the visible rays pass through and of reflecting the ultraviolet rays thereon, is provided on the inclined surface. As a consequence, among the parallel light rays from the optical conductor rod 3, the ultraviolet rays and the infrared rays are reflected by the filtering film 5 and taken out therefrom, and only the visible rays are guided into the optical conductor cable 4.

As mentioned heretofore, according to the present invention, the light-receiving edge of the optical conductor cable 4 is established so as to be slightly inclined in relation to the direction of the light rays' propagation. If the light-receiving edge of the optical conductor cable 4 is not inclined at all, the ultraviolet rays reflected by the filtering film 5 are at this time inversely transmitted through the optical conductor rod 3 to the light source lamp side and are reflected thereon and propagated to the optical conductor cable side again. After the repetition of such a cycle, almost all of the ultraviolet rays and infrared rays are guided into the optical conductor cable. If the light-receiving edge surface of the optical conductor cable 4 is inclined in relation to the direction of the light rays' propagation, as shown in the present invention, the light rays reflected on the inclined surface do not propagate to the light source side.

Fig. 3 is a cross-sectional view for explaining the construction of another embodiment according to the present invention. In that embodiment,

the light-receiving edge 4a of the optical conductor cable 4 is shaped in a concave fashion. By using such a shape, the parallel light rays from the optical conductor rod 3 can not only be guided more effectively into the optical conductor 4, but also the reflected light rays are focused, so that they can be effectively guided into the second optical conductor 6.

The ultraviolet rays taken out in such a manner as mentioned before may be allowed to dissipate. However, on some occasions, the ultraviolet rays may be guided into another optical conductor cable 6 for employing them in a desired way.

Moreover an absorptive filter can be employed instead of a reflective filter. However, if the absorptive filter is employed, the light components absorbed are converted to heat and the property of matter is thereby thermally changed. Therefore the absorptive filter may not be preferable for that reason.

An embodiment for separating the ultraviolet rays and the infrared rays from the artificial light source's light rays is described heretofore. However, the present invention is not limited to the afore-mentioned embodiment. For instance, in the case of nurturing, cultivating, and testing non-bacterial animals or plants, it is necessary to prohibit persons from entering the testing room. In such a case, according to the present invention, the light-emitting edge side of the optical conductor cable is guided into the non-bacterial room and the light source lamp can be put outside of it. Therefore, when the light source lamp is broken down, persons need not enter the non-bacterial room, making it very convenient.

Furthermore, in such a case, the necessary light components and the unnecessary or harmful light components will differ depending on the kinds of animals or plants to be nurtured or cultivated there. On such an occasion, a suitable filter has to be selected in relation to the kinds of animals or plants. Furthermore, the light components from the light source lamp may be employed also in accordance with the kinds of animals or plants.

As is apparent from the foregoing description, according to the present invention, a specially designed light component, for instance, an ultraviolet ray component can be effectively separated from among the light rays coming from an artificial light source lamp; and the more high-quality light rays for instance visible rays, can be guided into the optical conductor cable.

Claims

1. An artificial light source device comprising a light source lamp (1), a reflection mirror (2) for reflecting light rays from said light source lamp in the form of parallel light rays, an optical conductor rod (3) having a light-receiving edge surface placed opposite said reflection mirror, said parallel light rays being guided into said optical conductor rod, and an optical conductor cable (4), the light-receiving edge surface of which is placed opposite the light-emitting edge surface of said

reflection mirror 2, and 4 is an optical conductor cable consisting of a large number of optical fibers 4₁, 4₂, etc.

As shown in Fig. 1, the light rays from the artificial light source lamp 1 are converted to parallel light rays. The parallel light rays are initially guided into the optical conductor rod 3, and then further guided through the optical conductor rod 3 into the optical conductor cable 4. Furthermore, when the light rays from the artificial light source lamp 1 are guided through the optical conductor rod into the optical conductor cable in such a manner, the heat rays and the ultraviolet rays are among the light rays from the artificial light source, and the light rays can be effectively guided into the optical conductor cable.

However, in an artificial light source according to the present invention, pre-selected light components, for instance ultraviolet rays, are prevented from being guided into the optical conductor cable effectively and as a result more high-quality light components, for instance visible rays, can be guided into the optical conductor cable.

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As mentioned heretofore, according to the present invention, the light-receiving edge of the optical conductor cable 4 is established so as to be slightly inclined in relation to the direction of the light rays' propagation. If the light-receiving edge of the optical conductor cable 4 is not inclined at all, the ultraviolet rays reflected by the filtering film 5 are at this time inversely transmitted through the optical conductor rod 3 to the light source lamp side and are reflected thereon and propagated to the optical conductor cable side again. After the repetition of such a cycle, almost all of the ultraviolet rays and infrared rays are guided into the optical conductor cable. If the light-receiving edge surface of the optical conductor cable 4 is inclined in relation to the direction of the light rays' propagation, as shown in the present invention, the light rays reflected on the inclined surface do not propagate to the light source side.

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The ultraviolet rays taken out in such a manner as mentioned before may be allowed to dissipate. However, on some occasions, the ultraviolet rays may be guided into another optical conductor cable 6 for employing them in a desired way.

Moreover an absorptive filter can be employed instead of a reflective filter. However, if the absorptive filter is employed, the light components absorbed are converted to heat and the property of matter is thereby thermally changed. Therefore the absorptive filter may not be preferable for that reason.

An embodiment for separating the ultraviolet rays and the infrared rays from the artificial light source's light rays is described heretofore. However, the present invention is not limited to the afore-mentioned embodiment. For instance, in the case of nurturing, cultivating, and testing non-bacterial animals or plants, it is necessary to prohibit persons from entering the testing room. In such a case, according to the present invention, the light-emitting edge side of the optical conductor cable is guided into the non-bacterial room and the light source lamp can be put outside of it. Therefore, when the light source lamp is broken down, persons need not enter the non-bacterial room, making it very convenient.

Furthermore, in such a case, the necessary light components and the unnecessary or harmful light components will differ depending on the kinds of animals or plants to be nurtured or cultivated there. On such an occasion, a suitable filter has to be selected in relation to the kinds of animals or plants. Furthermore, the light components from the light source lamp may be employed also in accordance with the kinds of animals or plants.

As is apparent from the foregoing description, according to the present invention, a specially designed light component, for instance, an ultraviolet ray component can be effectively separated from among the light rays coming from an artificial light source lamp, and the more high-quality light rays for instance visible rays, can be guided into the optical conductor cable.

Claims

1. An artificial light source device comprising a light source lamp (1), a reflection mirror (2) for reflecting light rays from said light source lamp in the form of parallel light rays, an optical conductor rod (3) having a light-receiving edge surface placed opposite said reflection mirror, said parallel light rays being guided into said optical conductor rod, and an optical conductor cable (4), the light-receiving edge surface of which is placed opposite the light-emitting edge surface of said



optical conductor rod and which device employs the light rays from said optical conductor cable as a light source, the light-receiving edge surface of said optical conductor cable (4) being inclined in relation to the direction of the light rays' propagation and being provided with a filter (5) capable of letting only pre-selected light components pass through said inclined surface and of reflecting other pre-selected light components.

2. An artificial light source device as defined in claim 1, characterized in that said light-receiving edge surface of said optical conductor cable has a concave shape.

3. An artificial light source device as defined in claim 1 or 2, characterized in that said filter (5) is a film formed by evaporating gold.

4. An artificial light source device as defined in claim 1, 2 or 3, characterized in that there is a second optical conductor cable (6) with a light-receiving edge, through which cable said reflected light rays are guided.

Patentansprüche

1. Künstliche Lichtquellen Vorrichtung, mit einer Lichtquellenlampe (1), mit einem Reflexionsspiegel (2), der die von der Lichtquellenlampe abgegebene Strahlung als parallele Strahlung reflektiert, mit einem optischen Leiterstab (3), der eine dem Reflexionsspiegel gegenüberliegende Lichtempfangsfläche aufweist, wobei die parallele Lichtstrahlung in den optischen Leiterstab eingeleitet wird und mit einem optischen Leiterkabel (4), dessen lichtempfangende Fläche gegenüber der lichtemittierenden Fläche des optischen Leiterstabes angeordnet ist und wobei die Vorrichtung die Lichtstrahlung des optischen Leiterkables als Lichtquelle verwendet, und wobei die lichtempfangende Fläche des optischen Leiterkables (4) bezüglich der Lichtstrahlenfortpflanzungsrichtung geneigt und mit einem Filter (5) versehen ist, das nur vorbestimmte Lichtkomponenten durch die geneigte Fläche hindurchtreten läßt und das andere vorbestimmte Lichtkomponenten reflektiert.

2. Künstliche Lichtquelle nach Anspruch 1, dadurch gekennzeichnet, daß die lichtempfangende Fläche des optischen Leiterkables konkav geformt ist.

3. Künstliche Lichtquelle nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Filter (5) eine

Schicht ist, die durch Aufdampfen von Gold gebildet wird.

4. Künstliche Lichtquelle nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß ein zweites optisches Leiterkabel (6) mit einer lichtempfangenden Fläche vorhanden ist, wobei die reflektierten Lichtstrahlen durch dieses Kabel hindurch geleitet werden.

Revendications

1. Un dispositif à source de lumière artificielle comprenant une lampe (1) formant source de lumière, un miroir réfléchissant (2) pour réfléchir des rayons lumineux provenant de ladite lampe formant la source de lumière sous la forme de rayons lumineux parallèles, une tige conductrice optique (3) comportant une surface marginale réceptrice de lumière qui est placée à l'opposé dudit miroir réfléchissant, lesdits rayons lumineux parallèles étant guidés jusque dans ladite tige conductrice optique, et un câble conducteur optique (4), dont la surface marginale réceptrice de lumière est placée à l'opposé de la surface marginale émettrice de lumière de ladite tige conductrice optique, ledit dispositif utilisant les rayons lumineux provenant du câble conducteur optique comme une source de lumière, la surface marginale réceptrice de lumière dudit câble conducteur optique (4) étant inclinée par rapport à la direction de propagation des rayons lumineux et étant pourvue d'un filtre (5) capable de laisser passer seulement des composants lumineux présélectionnés au travers de ladite surface inclinée et de réfléchir d'autres composants lumineux présélectionnés.

2. Un dispositif à source de lumière artificielle tel que défini dans la revendication 1, caractérisé en ce que ladite surface marginale réceptrice de lumière dudit câble conducteur optique a un profil concave.

3. Un dispositif à source de lumière artificielle tel que défini dans la revendication 1 ou 2, caractérisé en ce que ledit filtre (5) est un film formé par évaporation d'or.

4. Un dispositif à source de lumière artificielle tel que défini dans la revendication 1, 2 ou 3, caractérisé en ce qu'il est prévu un second câble conducteur optique (6) comportant un bord récepteur de lumière et par l'intermédiaire duquel lesdits rayons lumineux réfléchis sont guidés.



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