

Apparatus for charging a plurality of photoluminescence therapeutic devices

The present invention relates to photoluminescence therapeutic devices, and in particular to an apparatus for charging such devices.

Photoluminescence therapeutic devices are known at the state of the art, generally consisting of a substrate on which are arranged materials capable of returning electromagnetic radiation, generally in the near infrared to ultraviolet range, which exert a beneficial effect on the patient being treated with such devices. Among the materials capable of offering this type of effect, nanoparticles in particular have been highlighted over the years, understood as particles with a size between 1 and 50 nm, which then interact with the incident light radiation and re-emit radiation by fluorescence or phosphorescence effect.

WO2021084424, filed by the same applicant of this application, describes therapeutic devices comprising a laminar support element and at least two quantum dots, i.e., two nanostructures, chosen from: Graphene, blue luminescence graphene, cyan luminescence graphene, aqua luminescence graphene, Perovskite coated with oleic acid and oleylamine, CdTe carboxylate, CdS/ZnS functionalized with oleic acid, wherein said support element is transparent to reference electromagnetic radiation, in addition to that emitted by the human body, one side of the device being suitable for contact with the patient's epidermis, and on the opposite side being positioned a mixture of at least two of the above-mentioned quantum dots with a concentration between 1.0 mg/cm² and 100.0 mg/cm², capable of emitting photons at the reference

wavelength, and with an intensity between 0.1 mW/cm² and 0.5 mW/cm², and preferably between 0.2 mW/cm² and 0.4 mW/cm², and wherein said reference wavelength is between 280 and 740 nm, and preferably between 350 and 530 nm, where stimulated by at least one infrared, visible, or ultraviolet electromagnetic radiation.

These devices, no matter how much they can be recharged either by electromagnetic radiation emitted by the patient's body or by natural light, still deplete their energy content, and must therefore be recharged appropriately. Optimal recharging takes place in a small-volume environment, where radiation is able to target a plurality of devices without excessive dispersion of light and thus of energy, and with as fast recharging time as possible.

It is therefore the aim of the present invention to provide an apparatus for charging devices of the type described above, which is developed in accordance with the requirements listed above, and which allows for the charging of a significant number of devices, consequently also enabling their sheltering in an organized and safe manner.

It is therefore an object of the present invention to provide an apparatus for charging and collecting a plurality of photoluminescence therapeutic devices, comprising a substantially parallelepiped box body, provided inside it with a support for housing a plurality of devices, and being arranged, on two mutually opposite inner faces of the walls of the box body means of emitting electromagnetic radiation between 280 and 740 nm, being provided means of powering the means of emission, said means of emission being oriented perpendicular to the plane of stationing

of said devices within the apparatus, and being provided with a lid for closing the box body.

In a preferred embodiment, the inner walls of the box body and lid are fully reflective of the electromagnetic radiations emitted by the emission means; in particular, the box body and lid may be made of steel, while alternatively they may be metallized only on the inward-facing surface. The lid is preferably hinged to the box body along one side between the two sides where the electromagnetic radiations emitting means are arranged. The support for housing the devices is a plate made of material transparent to the said radiations, and in particular is made of polycarbonate, polyethylene terephthalate, or similar crystalline polymers with high optical transparency. The devices are placed on the holder in a plurality of slots formed in the said plate, so that the devices are arranged with their axis parallel to the plane of the plate. The slits are arranged in a plurality of rows, spaced apart by a distance greater than the length of said slots.

The emission means of electromagnetic radiations will preferably be a plurality of LEDs, which may all be capable of emitting the same radiation or may be chosen capable of emitting radiation at different wavelengths; in addition, the LEDs used may be provided with means of dimming the light intensity. Specifically, the emission means each include a housing body provided with an opalescent wall, for better diffusion of electromagnetic radiation, in which the LEDs are housed. Advantageously, an additional emission means can be placed on the bottom wall of the box body, immediately below the device support.

These and other features and advantages of the present invention will become apparent more clearly from the following description of some non-limiting embodiments illustrated in the appended drawings in which:

fig. 1 is a perspective view of an executive form of the apparatus according to the present invention in a closed configuration;

fig. 2 is a perspective view of the apparatus of fig. 1, in open configuration;

fig. 3 is an exploded perspective view of the apparatus of figure 1;

fig. 4 is a sectional view along the IV-IV line of figure 2.

An embodiment of the apparatus according to the present invention is illustrated in Figure 1; 1 designates the parallelepiped box body, provided with a lid 101 hinged to the box body in 111, and provided frontally with the holes 301, which will be better described below.

Figure 2 shows the apparatus of Figure 1 in an open configuration; equal parts correspond to equal numerals; as can be seen, inside the box body 101 is arranged the support plate 201, provided with a plurality of slots 211, in which the photoluminescence therapeutic devices 10 are arranged, resulting in a vertical arrangement; at the two ends of the plate 201 are positioned the emitters 2 of electromagnetic radiation. The lid 101 is hinged to the box body, by means of the hinge 111. Holes 301 are formed on the front wall of the box body 1, which allow the operating status of the apparatus to be checked. The box body 1 and lid 101 are preferably made of steel, but they can

also be made of other metallic materials, as well as they can be made of nonmetallic materials with the faces of the walls facing the inside of the box body suitably treated to be fully reflective, in order to facilitate charging of the therapeutic devices.

In Figure 3 the apparatus according to the present invention is shown in exploded perspective; equal parts correspond to equal numerals. Particularly noticeable in the figure is the presence of the shaped wall 401, the flap 411 of which, folded 90° upward, makes it possible to form a partition of the interior of the box body, which will be better described below. In addition, an opening 501 is formed on the wall of box body 1 intended for connection with lid 101.

Figure 4 shows a sectional view along the IV-IV line of Figure 2; equal parts correspond to equal numerals. The figure clarifies the structure of emitters 2, which include within them a plurality of LEDs 102, in this executive form 7, and which have the wall 202 facing the inside of the container body made of an opalescent material, so as to promote the diffusion of the radiation emitted by the LEDs. Each emitter 2 is connected to the power supply 302, located in the partition originated by the flap 411, which in turn is provided with a connector 312, typically a USB connector, for connection with a power source, emerging from the opening 501 formed in the wall of the box body 1. A dashed line also shows an emitter 2' that is optionally arranged below the plane of the plate 201.

The operation and structure of the apparatus according to the present invention will appear more clearly from the following. As mentioned in the premises, photoluminescence therapeutic devices need to be conveniently recharged after a certain number of

hours in which they have released the radiation emitted by their respective quantum dots, and recharging undoubtedly becomes more effective if it can be performed for a relatively large number of devices in an environment in which the irradiation of the devices by appropriate light sources is optimized.

To this end, the apparatus of the invention provides a transparent support for electromagnetic radiation in which the devices are placed so that they are best exposed to the means of emission of said radiation. The support is a plate made of transparent plastic material, such as polycarbonate, polyethylene terephthalate, or other similar polymeric material having high optical transparency. The devices are arranged in a plurality of slots 211 arranged in multiple rows, and the rows are spaced apart by a distance substantially greater than the width of said slots. In the illustrated embodiment, only one plate 201 is provided for supporting the therapeutic devices, but a container body 1 capable of holding two support plates overlapping each other can be simply made to accommodate a larger number of devices.

Emission means 2 are made to contain a plurality of LEDs 102, which can be the same as each other, i.e., capable of emitting radiation in the same wavelength range of 280 to 740 nm, as well as can be divided into infrared LEDs, visible light-emitting LEDs, and ultraviolet LEDs. In addition, LEDs emitting in the visible spectrum can be white light, just as they can be LEDs emitting light of a particular color of the visible spectrum.

The apparatus according to the present invention can be powered by an external power source, as well as can be provided with a rechargeable battery.

The apparatus according to the present invention enables efficient and well-organized recharging of a plurality of photoluminescence therapeutic devices, with a simple structure, and which can be easily developed in a modular manner.

CLAIMS

1. An apparatus for charging and collecting a plurality of photoluminescence therapeutic devices (10), comprising a substantially parallelepiped box body (1) provided within it with a support (201) for housing a plurality of devices, and being arranged, on two mutually opposite inner faces of the walls of the box body, means of emission (2) of electromagnetic radiation between 280 and 740 nm, being provided means of powering (302) the means of emission (2), said means of emission (2) being oriented perpendicular to the plane of standing of said devices (10) within the apparatus, and being provided a lid (101) for closing the box body (1).
2. Apparatus according to claim 1, in which the inner faces of the walls of the box body (1) and lid (101) are completely reflective of the electromagnetic radiation emitted by the emission means (2).
3. Apparatus according to claim 1 or 2, in which the box body (1) and lid (101) are made of steel.
4. Apparatus according to claim 1 or 2, in which the box body (1) and lid (101) are metallized only on the inward-facing surface.
5. Apparatus according to any one of the preceding claims 1 to 4, in which the device housing support (10) is a plate (201) made of material transparent to electromagnetic radiation, provided with a plurality of slots (211) for housing the devices (10), arranged so that the devices (10) are positioned with their axis parallel to the plane of the plate (201).
6. Apparatus according to claim 5, in which said plate (201) is made of polycarbonate, polyethylene

terephthalate, or similar crystalline polymers with high optical transparency.

7. Apparatus according to claim 5 or 6, in which the slots (211) are arranged in a plurality of rows, spaced apart by a distance greater than the length of said slots (211).
8. Apparatus according to any one of the preceding claims 1 to 7, wherein the emission means (2) of electromagnetic radiation comprises a plurality of LEDs (102).
9. Apparatus according to claim 8, in which the emission means each comprise a container body (2) provided with an opalescent wall (202), in which the LEDs (102) are housed.
10. Apparatus according to any of the preceding claims 1 to 9, in which an additional emission means (2') can be placed on the back wall of the box body (1), immediately below the support (201) of the devices (10).