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(54) Title: COMPACT UVB LIGHT THERAPY DEVICE FOR TREATING DERMAL CONDITIONS

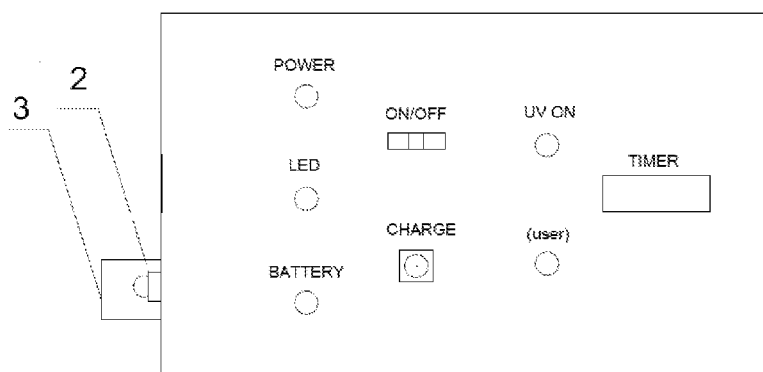


Fig.1

(57) Abstract: A compact UVB light therapy device, containing an enclosed, combined light source, a serially connected power switch with a timer unit, and at least one light source –a LED emitting radiation of 310 nm in wavelength and 0.6-1 mW in optical power, connected to the timer, and a detachable spacer covering the light source is fixed in the vicinity of the light source.

## COMPACT UVB LIGHT THERAPY DEVICE FOR TREATING DERMAL CONDITIONS

The subject of the invention is a compact UVB light therapy device, particularly intended for the treatment of vitiligo, atopic dermatitis and psoriasis.

Light therapy, also referred to as phototherapy, is a rapidly developing field of medicine and pharmaceuticals. Contemporary phototherapy applies a wide spectrum of visible light frequencies, plus the ultraviolet and infrared ranges. The phototherapeutic psoriasis, atopic dermatitis and vitiligo treatment method applies UV radiation sources. According to various sources, the global incidence of vitiligo is 1-2% of the entire population, approximately 30% of the population suffers from atopic dermatitis, and psoriasis is a menace to 2-4% of the population. Currently, science distinguishes three types of UV radiation suitable for treating the aforementioned diseases: PUVA therapy, Broadband UVB and Narrow band UVB.

The PUVA method assumes the application of type A ultraviolet rays in a band of 340-400 nm. UVA radiation is often accompanied by the administration of photosensitizing drugs, out of which the most popular one is psoralen (a natural compound, found in specific plants). In another possible treatment method, drugs are not administered, and the volume of phototherapy is increased. Application of this method must be performed in dedicated clinics three times a week. Human skin is very resistant to UVA radiation, since it reaches us from the sun and, in order for the treatment to bring the desired results, we need drug-assisted therapy or increased radiation powers. Due to the fact that UVA radiation passes through glass and can penetrate the body, we need special ocular protection and suitable covers of body parts which need to be excluded from radiation.

The broadband method applies 290-315 nm radiation. UVB radiation is generally considered to be safer, as it does not easily pass through human skin and does not constitute as much of a threat to UVA. In addition, due to increased energy capacity of

the radiation, it is possible to apply shorter exposure times, which reduces the patient's exposure to the negative effects of UV radiation. This method required supplementary drug therapy. Depending on the severity of the disease, the patient should undergo radiation 2-5 times a week. There are some available ready-to-use solutions on the market, which allow for conducting the therapy at home. One of the disadvantages of such therapy is that it can cause erythema, as it produces wavelengths which are dangerous to human health, i.e. above 290 nm.

Narrow band UVB therapy is a latest development, producing very promising results in cosmetic and medical applications. 311-312 nm UVB rays are used in the procedure, as they are the most effective for medical applications. One of the advantages of narrow-band sources is the absence of radiation below 290 nm. This method required however drug administration. It is more effective and more efficient in producing the desired effects, compared to the broadband UVB method. This method can be applied locally, for certain body parts, and for the entire body.

Patent ref. UA99068 describes a light therapy method, where particular body parts are exposed to 310 nm UV rays. For the duration of therapy, the dosage of radiation is increased by 20%. After that, the patient receives 1 ml of solution comprising stem cells and continues the light treatment, beginning with light of 80mJ/cm<sup>2</sup> in total energy. Patent solution ref. RU2472541, registered in Russia in 2011, displays a method of treating acne, consisting in the illumination of skin with UV A and B light. In addition to the light therapy, the patient receives 10 mg of liptonorm for 21-28 days. A device according to patent ref. EP1420741 contains a base unit and at least one head unit attached to it. Particular elements of the device are adjusted to different UV light therapies, LLLT, ultrasound therapy, electrostimulation therapy, cryotherapy, and heat therapy using various diodes. A multifunctional light therapy device is also known from patent description ref. CN103801007, which introduces a device equipped with at least one insolation head unit, which is furnished with LED diodes emitting infrared or UV light. Patent description ref. US6471716 presents a device containing a matrix comprising numerous LED diodes emitting light of a wavelength corresponding to the near infrared range

The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment according to the invention is devoid of any of the limitations related to the other available methods. The solution developed is suitable for use by individual clients, without the need to perform elaborate procedures in cosmetic salons or medical clinics. The device is handy, small and can therefore be used when performing other activities. Furthermore, the device is suitable for use at higher frequencies. Frequent therapy involving lower light concentrations is more effective than a smaller number of high-power insolation sessions. The device according to the invention contains at least 1 LED emitting 310 nm radiation, a spacer and a transparent cover for UVB rays, to maintain the proper distance from the insulated spot and to protect the LED against dust and impurities, plus signaling LEDs, a timer counting the session time, a min. 1A charger, a power switch and two other switches. The signaling diodes include 1 red diode, which lights up when the device is charging, and which goes out when the device is fully charged, 2 blue diodes, which light up together with the UV diodes, 1 green diode, which illuminates in continuous light when the power is on, or blinks every 1 sec. when the batteries are low.

The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source, a serially connected power switch with a timer unit, and at least one light source of 310 nm in wavelength and 0.6 to 1 mW in optical power, connected to the timer, and a detachable spacer covering the light source is fixed in the vicinity of the light source, whereas the spacer is at least 0.5 cm high, as measured from the surface of the casing in the vicinity of the light source to the external surface of the spacer. Whereas, a LED diode is the light source, and the timer unit allows for setting the LED illumination period with the accuracy of at least 0.5 seconds.

In a beneficial embodiment, at least one additional visible light LED, preferably blue, is installed in the vicinity of the UVB light source, allowing for the observation of the insolation area. In a beneficial embodiment, at least one additional battery charging or device state diode is connected to the power supply and power switch circuit.

In a beneficial embodiment, the power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes and visible light diodes allowing for the observation of the insulated area.

In a beneficial embodiment, the device is powered from an in-built battery or a  
5 charger of at least 1A.

The compact UVB light therapy device was presented in a figure, in which fig. 1 illustrates the layout of the device according to the invention, fig. 2 illustrates the cross-section of the device according to the invention.

#### Example 1

10 The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source 1, a serially connected power switch 5 with a timer unit 6, and at least one light source – a LED 2 emitting radiation of 310 nm in wavelength and 0.8 mW and higher in optical power, connected to the timer 6, and a detachable spacer 3 covering the light source is  
15 fixed in the vicinity of the light source, whereas the spacer is 1 cm high, as measured from the surface of the casing in the vicinity of the light source to the external surface of the spacer. The timer 6 allows for setting the LED illumination period for 600 sec.

An additional visible light LED, preferably blue, is installed in the vicinity of the UVB light source, allowing for the observation of the insolation area. An additional battery  
20 charging or device state diode is connected to the power supply and power switch circuit.

The power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes and visible light diodes allowing for the observation of the insulated area.

The device is powered from an in-built battery or a charger of at least 1A.

#### 25 Example 2

The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source 1, a serially connected power switch 5 with a timer unit 6, and at least one light source – a

LED 2 emitting radiation of 310 nm in wavelength and 0.8 mW and higher in optical power, connected to the timer 6, and a detachable spacer 3 covering the light source is fixed in the vicinity of the light source, whereas the spacer is at least 0.5 cm high, as measured from the surface of the casing in the vicinity of the light source to the external surface of the spacer. The timer 6 allows for setting the LED illumination period for 600 sec.

An additional visible light LED, preferably blue, is installed in the vicinity of the UVB light source, allowing for the observation of the insolation area. An additional battery charging or device state diode is connected to the power supply and power switch circuit.

10 The power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes and visible light diodes allowing for the observation of the insulated area.

The device is powered from an in-built battery or a charger of at least 1A.

#### Example 3

15 The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source 1, a serially connected power switch 5 with a timer unit 6, and at least one light source – a LED 2 emitting radiation of 310 nm in wavelength and 0.8 mW and higher in optical power, connected to the timer 6, and a detachable spacer 3 covering the light source is  
20 fixed in the vicinity of the light source, whereas the spacer is at least 1 cm high, as measured from the surface of the casing in the vicinity of the light source to the external surface of the spacer. The timer 6 allows for setting the LED illumination period for 300 sec.

25 An additional visible light LED, preferably blue, is installed in the vicinity of the UVB light source, allowing for the observation of the insolation area. An additional battery charging or device state diode is connected to the power supply and power switch circuit.

The power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes and visible light diodes allowing for the observation of the insulated area.

The device is powered from an in-built battery or a charger of at least 1A.

#### Example 4

The compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source 1, a  
5 serially connected power switch 5 with a timer unit 6, and at least one light source – a  
LED 2 emitting radiation of 310 nm in wavelength and 0.8 mW and higher in optical  
power, connected to the timer 6, and a detachable spacer 3 covering the light source is  
fixed in the vicinity of the light source, whereas the spacer is at least 0.5 cm high, as  
measured from the surface of the casing in the vicinity of the light source to the external  
10 surface of the spacer. The timer 6 allows for setting the LED illumination period for 600  
sec. An additional visible light LED, preferably blue, is installed in the vicinity of the UVB  
light source, allowing for the observation of the insolation area. An additional battery  
charging or device state diode is connected to the power supply and power switch circuit.

The power switch of the device is doubled in a manner that its circuits provide  
15 independent power supply to UVB diodes and visible light diodes allowing for the  
observation of the insulated area.

The device is powered from an in-built battery or a charger of at least 1A.

## Patent claims

1. A compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source (1), a serially connected power switch (5) with a timer unit (6), and at least one light source (2), and the electronic elements of the device are connected with a wire (4), characterized in that a LED (2) emitting radiation of 310 nm in wavelength, up to 10 nm in full width at half maximum, and 0.6-1 mW in optical power is the light source, and a detachable spacer (3) covering the light source is fixed in the vicinity of the light source
2. The device according to claim 1, characterized in that the diode is 0.8 mW in total power.
3. The device according to claim 1 or 2, characterized in that the spacer is at least 0.5 cm high, as measured from the surface of the casing in the vicinity of the light source to the external surface of the spacer.
4. The device according to claim 1 or 2 or 3, characterized in that the timer controlling the light source allows for setting the LED illumination period with the accuracy of 0.5 second, preferably for 300 or 600 sec.
5. The device according to claim 1 or 2 or 3 or 4, characterized in that an additional visible light LED, preferably blue, is installed in the vicinity of the UVB light source.
6. The device according to claim 5, characterized in that the observation diode emits blue light.
7. The device according to claim 1 or 2 or 3 or 4 or 5, characterized in that An additional battery charging or device state diode is connected to the power supply and power switch circuit.
8. The device according to claim 1 or 2 or 3 or 4 or 5 or 6 or 7, characterized in that the power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes and visible light diodes allowing for the observation of the insulated area.



9. The device according to claim 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8, characterized in that the device is powered from an in-built battery or a charger of at least 1A.

**AMENDED CLAIMS**  
**received by the International Bureau on 30 March 2017 (30.03.2017)**

Patent claims

1. A compact UVB light therapy device, particularly intended for vitiligo, atopic dermatitis and psoriasis treatment contains an enclosed, combined light source (1), a serially connected power switch (5) with a timer unit (6), and at least one LED light source (2), and the electronic elements of the device are connected with a wire (4), characterized in that the LED light source (2) emitting radiation of 310 nm in wavelength, up to 10 nm in full width at half maximum, and 0.6-1 mW in optical power is the light source, and a detachable spacer (3) covering the LED light source (2) is fixed in the vicinity of the LED light source (2)
2. The device according to claim 1, characterized in that a diode of the LED light source (2) is 0.8 mW in total power.
3. The device according to claim 1 or 2, characterized in that the spacer (3) is at least 0.5 cm high, as measured from the surface of the casing in the vicinity of the LED light source (2) to the external surface of the spacer (3).
4. The device according to claim 1 or 2 or 3, characterized in that the timer controlling the light source allows for setting the LED illumination period with the accuracy of 0.5 second, preferably for 300 or 600 sec.
5. The device according to claim 1 or 2 or 3 or 4, characterized in that an additional visible light LED, preferably blue, is installed in the vicinity of an UVB light source.
6. The device according to claim 5, characterized in that the observation diode of the additional light LED emits blue light.
7. The device according to claim 1 or 2 or 3 or 4 or 5, characterized in that An additional battery charging or device state diode is connected to a power supply and power switch circuit.
8. The device according to claim 1 or 2 or 3 or 4 or 5 or 6 or 7, characterized in that the power switch of the device is doubled in a manner that its circuits provide independent power supply to UVB diodes of the LED light source (2) and visible light diodes of the additional light LED allowing for the observation of the insolated area.
9. The device according to claim 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8, characterized in that the device is powered from an in-built battery or a charger of at least 1A.

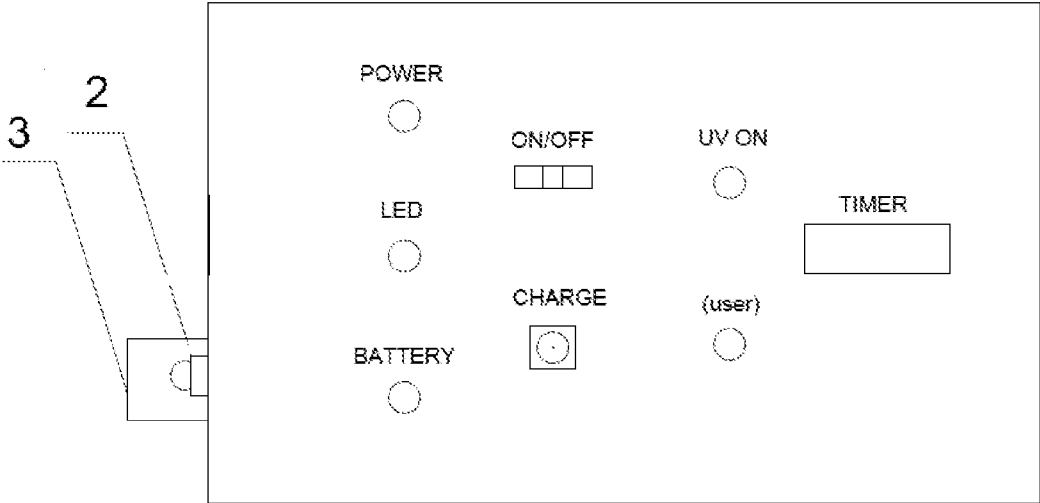


Fig.1

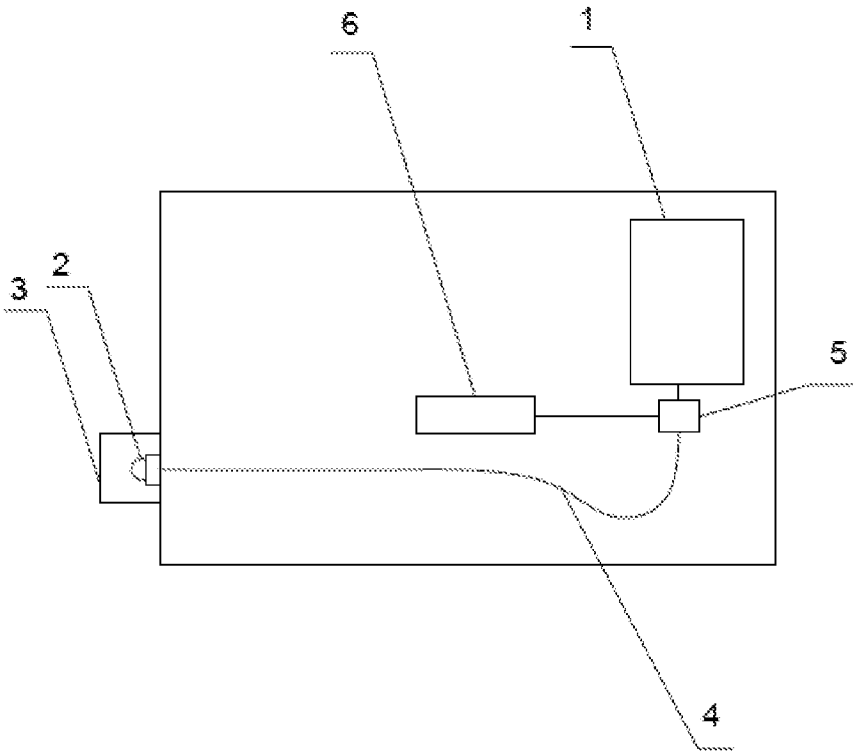


Fig. 2.

## INTERNATIONAL SEARCH REPORT

International application No

PCT/PL2015/050064

## A. CLASSIFICATION OF SUBJECT MATTER

INV. A61N5/06

ADD.

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61N

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	US 2006/167531 A1 (GERTNER MICHAEL [US] ET AL) 27 July 2006 (2006-07-27) paragraphs [0086], [0092], [0095], [0099], [0115], [0123], [0156], [0159], [0203], [0206], [0209], [0222]; claim 39; figures 1A-B, 10A-E paragraphs [0235] - [0237] -----	1-9
X	US 2006/206173 A1 (GERTNER MICHAEL [US] ET AL) 14 September 2006 (2006-09-14) paragraphs [0049], [0060], [0095], [0109], [0112], [0114], [0122]; figures 5B, 5E, 12 -----	1, 3-9



Further documents are listed in the continuation of Box C.



See patent family annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/PL2015/050064

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