WEARABLE APPARATUS HAVING DEFORMABLE EXTENSION UNITS FOR APPLYING RADIATION ONTO SKIN

A wearable radiation applying device capable of simultaneously treating several skin wrinkles or lesions e.g., by light-treatment, and a method of treatment the same, are disclosed. The device comprises a support wearable e.g., on the user's head and configured for receiving and supporting at least one extension unit, e.g., a goose-neck-like arm carrying spot illumination or other energy delivering element at an end thereof, thereby allowing the illumination or other energy delivering element to be adjustable positioned in a desired orientation to radiate towards any specific skin wrinkle or lesion located on a user's face, scalp or neck tissue. The extension units are preferably detachable from the support, thus providing for modularity. The device and its support as conceived in the present invention intend to minimize the user discomfort and to allow mobilization of the user during prolonged light treatment sessions especially problematic in non-thermal light energy treatments, LED photomodulation, and the like.
Published:
— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
The present invention is in the field of wearable devices for cosmetic and/or medical treatments of humans’ skin (epidermal, dermal or immediately underlying tissues) by means of irradiating it by electromagnetic energy (e.g. light), by vibrational energy (e.g. ultrasonic or subsonic energy), or by magnetic fields. More specifically the invention is in the field of wearable supports, for carrying irradiation sources such as LHD and Laser treatment devices on a body of a person to be treated.

Background of the Invention

Roughly 45 million people in the US are afflicted by the skin condition acne vulgaris. It is associated with lesions on the skin that are unsightly but can also be painful and leave scars.

The exact etiology of acne remains controversial. Keratinous material initially plugs the duct of a sebaceous gland. Sebum is produced and trapped, thereby enlarging the gland. The propionibacterium acnes (P. acnes) bacterium, which is a normal part of the skin flora, propagates in the gland due to the sebum buildup. These bacteria are inflammatory and may lead to the formation of the acne pustules.

Treatments typically include topical and device therapies. Topical treatments are aimed at removing follicular plugs and cleaning the sebaceous glands. Chose treatments are useful in treating some minor forms of acne. Oral treatments include antibiotics to suppress the growth of P. acnes. However, these treatments have side effects typical of these drugs, such as skin dryness, digestive problems, and the development of antibiotic-resistant bacteria.
It is known that the P. acnes bacteria produce porphyrins. The particular porphyrin typically produced by P. acnes has a peak in absorption at 415 nanometer*. There are also results of different researches in phototherapy and photomodulation of cellular livify with light (hat lights of several spectral hands as red light around 660 nanometer, yellow light around 590 nanometer and other spectral wavelengths in research have an anti-inflammatory effect on tissue, increase cell metabolism and may therefore aid in improving healing of pustules, in treating skin lesions and in reducing lace wrinkles. More recently, the use of multiple wavelengths as both blue light (e.g., 115 nm) and red or yellow light (e.g. centered at 660 nm, 590 nm) in the treatment of acne has been described. These lights can be applied with and without photo enhancers. These devices typically use high intensity light sources (e.g. high energy fluorescent bulbs and high power I HDs) not always treatment justified but instrumental in reducing the treatment time to a period that is acceptable for a person to sit still and to a session time profitable for the cosmetic service provider.

Summary of the invention

The present invention relates to a portable and wearable apparatus for applying radiation onto skin locations of a user, comprising (i) a wearable support mechanism configured to be attached over a portion of the user's head, neck or shoulders; (it) one or more moveable and/or flexible radiation directing arms constituting extension units each of which being attached at one end to said wearable support mechanism and which other end tonstituling a radiating lip is free and is adapted to radiate said radiation; (UI) Longtio circuitry and a power source configured to activate and control radiation emitting elements provided in said wearable support mechanism and/or in said one or more radiation directing arms.

wherein a direction and a shape of said one or more extension units are adjustable by the user such that their radiation emitting free ends are moveable each within a respective predetermined coverage area thus can be placed adjacent any specific point of the users' skin to be selected by the user within said respective coverage area for applying said radiation thereto.
Placed enably the wearable units are configured to allow for cross linking between points on the wearable support from which extension units protrude and points on a user's skin to be radiated, such that an extension unit protruding at a proximal end thereof from the wearable support and is facing at its distal end a point on a user's skin thus linking between said point of protrusion and point on the skin may be crossed over by another extension unit linking between different respective points.

It is appreciated that a skin region which may be recognized by a user as requiring a treatment may vary in size according to the type of treatment requiring problem (either medical or of cosmetic nature). Accordingly the contact area between a radiating tip and a user's skin may commonly constitute a fraction of between 0.01% - 25% of the coverage area of an extension unit having said radiating tip at its free end, depending on the size of the tip and on the separability freedom of the respective extension unit. If the size of a radiating tip provides for a contact area of 5 squared centimeters between it and a contacted skin, and said tip is mounted on an extension unit having a limited coverage area e.g. of 20 squared centimeters than the contact area is 25% of the coverage area. If however the size of the radiating tip provides for e.g. a contact area of 0.5 squared centimeters between it and a contacted skin, and said tip is mounted on an extension unit having a broader coverage area e.g. of 100 squared centimeters, than the contact area constitutes a fraction of 0.5% of the contact area.

In various preferred embodiments of the invention at least one extension unit comprises a connector at a distal end thereof matching a connector of a radiation tip, thereby allowing for separation between the extension unit and the radiation tip and for modularity in combining between extension units and different types of radiating tips having compatible connectors.

It is within the scope of the present invention wherein a radiating source is contained within the wearable support and wherein the radiation is delivered to the radiating tip by a wave guide contained within a respective extension unit.

It is also within the scope of the present invention wherein a radiating source is contained within an extension unit and wherein the radiation is delivered to the radiating tip by a wave guide or/and an optical assembly contained within the extension unit.
In various preferred embodiments of the invention the radiating source is contained within at least one radiating tip and the energy for generating radiation is delivered to the radiating source by conductor*, contained within a respective extension unit.

In various preferred embodiments of the invention a body of at least one extension unit comprises a gooseneck like structure.

A body of the of least one extension unit may thus comprise one or more joints, either as part/s of the gooseneck structure or as an alternative multi joint structure resulting in deformability of the extension unit thus providing it with a predetermined coverage area.

Preferably at least one extension units is/are detachable unit/s having connective members provided respectively in proximal ends thereof capable of being physically attached to matching connectors located in fixed or in rotatable ports provided in the wearable support.

According to the present invention the apparatus may comprise one or more radiation sources capable of emitting light, heat, magnetic field, mechanical vibrations or combinations thereof.

One or more sensors assembled in the free ends of the one or more extension units may be included in the device according to the present invention, for monitoring skin and/or radiation parameters. The sensors are electrically linked to the control circuitry for controlling an activation regime and intensity of the radiation sources.

In order to (i) improve contact between the radiating tip and a user's skin (ii) provide for tracing skin topography by the tip, and (iii) protect the eyes of the user from the emitted radiation, the apparatus according to the invention may further comprise a compressible sponge like rim at an end of the radiating tips facing the skin.

In various embodiments of the invention a distal end of at least one extension unit is movable respective to a mid portion of the unit through a flexible member or through a
friction ball joint thereby improving contact between the radiating tip and a user's skin local topography,

The apparatus (hereinafter termed also 'device') of the Invention is aimed at affecting the user's tissue by means of applying to it electromagnetic waves, magnetic fields, inc-Lh.inic.il ultrasonic vibrations, or combinations thereof.

In a preferred embodiment of the invention the device comprises (i) a wearable support (ii) a plurality of spot illumination tips or other energy delivering tips (hereinafter will be referred to also as 'radiating tips'; 'light tips' or simply 'tips') anchored to the support through a respective plurality of deformable extension units (The term deformable used herein refers to the ability to change and adjust the shape of the extension units in anyone of the preferred embodiments of the invention in order to place their radiation emitting lips over a desired location over the patient's body. This property of the extension units mainly relates to the ability to curve and twist portions along their length which may be provided in various ways, inter alia, by using flexible tubes or conduits (e.g., made from a soft metal), preferably by implementing radiation emitting tips having a type of segmented tube known as a gooseneck wherein the segments of the tube have some freedom of movement, particularly tilt movement, thereby allowing to adjust its shape), wherein a spot illumination tip attached to an end of the extension unit is movable with the extension at user's will between substantially remote points of treatment over a skin area of the user's body within a coverage area of the extension unit (i.e., the skin surface area over which a distal end of a respective extension unit is movable by deforming the extension unit) without disconnecting the extension unit from the wearable support, and wherein the extension unit, the tip, or their combination are configured to maintain a spot illumination focused on a selected treatment point with the user ficc handed. The extension units thus allow a user wearing the device to utilize each spot illumination tip independently of the others by configuring each extension unit separately at will for having its spot illumination maintained on a skin point currently selected for treatment. In the context of the present invention the terms "a skin point" and "a treatment point" refer to a point on the outer surface of the skin approximated by a user as the middle of a small area, normally of between one squared millimeter and two or three squared centimeters currently selected for treatment by bringing the tip to be maintained next to.
Preferably a coverage area of an extension unit on a user's skin is at least 25 squared centimeters (about four squared inches). In the context of the present invention "a cuvciagi; aiva of extension unit" is the total skin surface area against which a radiating (ip a distal nil of respective extension unit may be aligned taking advantage of the delbrmtibility of the extension unit and of the pivoting ability of its proximal end connection with the wearable support. In preferred embodiments of the invention the extension units; are configured to allow for a cross linking, thereby allowing a user to move a sput illumination tip linked to a treatment point located from a first side of another extension unit to be linked to a treatment point located from un opposite side of that unit without inter rupting a photo treatment carried by the extension unit thus crossed. Preferably a total length of at least one extension unit provided with a wearable support exceeds the distance from a middle of the wearable support to a remotest treatment point intended to be treated by the device, thereby assuring a full coverage of the device over the skin area within which a treatment requiring point may be located.

In various preferred embodiments of the device a distal end of at least one extension unit is movable respective to a mid portion of the unit through a flexible member thereby improving contact between the radiating tip and a user's skin local topography. Such flexible member may be for example in the form of a helical spring, with conductors or wave guides passing through its hollow center connecting between a radiating lip and a respective radiation or energy source.

Alternatively said extension unit movability can be achieved using a common free ball friction mechanism.

In various embodiments, the device of the present invention comprises a wearable support mechanism. (hereinafter "head-strap") preferably an adjustable headphone-like head band, made of a combination between rigid and flexible materials configured for holding the device on a user's head, and alternatively a forehead headband or an arched band resting on the back of the user's neck. The wearable support has a plurality of instantly connectable and alternatively permanently fixed, detbrmable and shape maintaining light poles (hereinafter "light arms") constituting extension units each of which ending with a miniature housing of an energy delivering element for example a light delivery housing of light generating or light conducting element, or of a
combination of bulk cu&slitulirig a light-tip; A light source for the light tip may comprise at least one light emitting element e.g. 1.FDs, laser diode device, or chemical reaction based HgI emitter or a combination thereof, the light being emitted from is of either a single wavelength, a wavelength band, or multiple wavelengths multi-spectral light. The device may further comprise light conducting elements such as lenses, prism*, or a combination between lenses and fiberoptic light guides useful for the provision of a spot illumination having properties (e.g. intensity, spatial and spectral distribution) effective for the treatment. In various embodiments of the device miniature light-tips (and/or other radiating lips) are connected to the head-strap by thin and light weighing electrical cords ending with a miniature electrical connector and constituting extension utrib, wherein their positioning against the user's skin is by non-permuntj πl gluing mean*, such as sticky gel, ordinary sticking plasters, elastic band, and the like.;

The device further comprises control electronics for programming the energy delivering session for example the light treatment sessions in terms of light modulation, light intensity, and activation cycles of the different light wavelengths delivered to the tissue.

In various embodiments the device may comprise power drivers for said radiation lips (e.g. said light emitting elements) and control electronics which preferably is configured to automaticaIV, recognize the type of the radiation tip currently connected; replaceable batteries (rechargeable or ordinary disposable ones); power management electronics; and alternatively internal rechargeable batteries (e.g. Li Ion polymer, etc.) and charger electronics and also carphone/s attached to the head-strap and signal conditioning deUronies for audio/musuc user’s comfort; an audio cable port or an optional wireless communication mean (e.g. Bluetooth, Wilbee, LIWB, WUSB, ZigBee, etc.);

In various embodiment-, the device will Comprise a separate housing for encasing said power source and control electron ic. said housing is to be electrically wired by the user to said wearable support mechanism when put to use, and is to be connected to a charger for night hours or at need. This proposed separate electronic box configuration will enable several users in a family each having its own wearable support, Io consecutively share the same electronic box.

In various preferred embodiments of the device the light-arms carry either through or externally embedded conductors (current wires) for energizing light generating elements
located at lhuir light lips (i.e., at lhoir distal end$^\dagger$). The light arms will preferably end
with a fast replaceable cone-like shaped light tip housing the LCD/$\ddagger$ or Laser emitting
device. In order to protect the user's eye from direct and stray light. For further
protection, on a rim surface of the tip the user will be able to fast attach e.g. by ron-
permifinch$^\dagger$ Sticky Glue, one-time-replaceable ring shaped (not necessarily circular)
sponge-like pads (hereinafter will be referred to also simply "pads") that will compress
to fit the user's skin profile, light-seal the illuminated region and protect the user's eye
from reflected stray light. Said sponge-like pads that will serve also as sanitation protection
of the user skin from direct contact with the said housing, will optionally be covered
with foam tape non-permanent Sticky del for sticking to the user's skin for better light
scaling while ottering lower inconvenience at their removal.

In some preferred embodiments of the invention, the head-strap comprises dwtries-
mechanical connectors of a fast attachment type for instantly connecting to it.
mechanically and electrically, gooseneck-like shaped light-arms each of which carrying
at least one IHl) or optionally Laser emitting device. The said fast attachment
arrangement will enable a user to chose and connect to a said head-strap residing
connectors light arms of different lengths, in order to easily reach places, on user's face,
neck or scalp that are closer or more distant to the said connector and also to chose and
instantly connect light-arms carrying different light tips of different sizes that can
comprise LFDs of different wavelength band, peak power rate, irradiating spot size,
beam shape, or other physical properties, from a collection of light arms which may be
sold with the apparatus, for different treatment types.

In a further preferred embodiments of the invention, the said light arms comprise at
their distal end electrical-mechanical connectors of a fast attachment type for instantly
connecting to it, mechanically and electrically, said various radiating (ips of different
sizes for treating different types and sizes of skin lesions or stimulating the underlying
tissue or acupuncture point, from a collection of light tips which may be offered for sale
with the apparatus, for different treatment types.

In a modified version of one above mentioned embodiment of the apparatus wherein
said miniature light-tips are connected to said head-strap by light and thin electrical
cords constituting the extension units, the cord end with a miniature electrical connector
for connecting with opposite matching connector embedded with baid head-strap. In this modified embodiment, the positioning of said miniature light-tips against the user’s skin (with the light tips embedded Integral or connected by connectors) will be achieved by sticky gel, ordinary sticking plasters, any other non-permanent gluing means or elastic band, etc. Optionally, the said light and thin electrical cords constituting the extension units may be formed of a retractile coiled cord type for enabling the user to conveniently reach more distant skin tissue loci.

In a combined embodiment according to the present invention the said apparatus’ may comprise both (i) derormable shape maintaining poles such as gooseneck-like light-arms and (ii) electrical cords, constituting the extension units through which light-tips are connected to the head strap, thus providing the user with maximum flexibility and convenience in reaching the lesion spot and treating his skin and tissue problems.

In a further alternative embodiment the said head-strap will comprise said LED, or laser light sources and the said extension units will comprise light conducting guides (e.g. of a fiber-optic type) instead of electrical wires. The thus further modified embodiment will comprise light coupling connectors mediating it to the head-strap and its light lips will comprise fiberoptic light coupler, and focusing elements.

The portability of the apparatus of the present invention greatly increase the user’s comfort and enable prolonged home light treatments while the user can move around and perform his normal activities.

The concept of the invented apparatus and light foci light or other irradiation treatment method of operation that enable the user to continue performing its normal activities is applicable to other light or other through skin energy treatments of the human body as well. These may include e.g. light-acupuncture treatments, or pain reducing treatments.

The optional audio or audio video feature of the apparatus of the present invention can also greatly improve user’s comfort during prolonged or repetitive light treatment.

The present invention further relates to a method for applying radiation to selected points and regions within skin areas of the user’s body, comprising:
attaching a wearable support mechanism over a portion of the user's body near the skin area to be radiated;

directing and adjusting at least one deformable extension unit protruding from the wearable support such that a tree radiation emitting end thereof is placed against a point on the skin of the user to which radiation is to be applied; and

activating a respective number of radiation sources to apply radiation via said at least one extension unit according to a predetermined electronic program.

The method according to the invention is applicable with the wearable support mechanism being attached either over a head, neck or shoulder portion of the user's body.

The method may further comprise a step of choosing and attaching to an extension unit a specific radiation tip having characteristics especially adapted for treating a particular skin lesion.

In various embodiments the control means is adapted to activate the radiation sources such that a radiation having pre programmed characteristics serving/matching a radiating tip being used for treating a specific skin loci may be selected by the user from a menu as yet further step of the method and applied to the radiating tip respectively.

Preferably at least one extension unit is detachable hence the method further comprises a step of attaching a specific number of said at least one unit according to a number of separate skin regions to be treated.

The present invention thus provides for non thermal irradiation treatments of skin and lissie problems, e.g. of cosmetic significance, especially on a user's face, neck and scalp. The invention relates to affecting the user's skin (either epidermal, dermal, or innicidintd underlying tissues of the skin) by means of applying to it electromagnetic waves, magnetic fields, mechanical ultrasonic vibrations, electrical currents (preferably in the range of micro-currents), or combinations thereof.

The method comprises (i) providing a wearable support that can be worn on a user's head for prolonged treatment session time durations (e.g. several hours for every
session), without causing physical discomfort to the user and without interrupting his/her normal activities; (ii) providing the wearable support with at least one spot illumination element (or with element capable of applying other types of electromagnetic radiation, magnetic field, sub sonic or ultrasonic vibrations, currents (preferably in the range of microamper-currents) or combination, thereof concentrated to stimulate a spot like treatment area) adapted for the implementation of time consuming treatments; and (iii) (henceforth "the device"). The device enables the delivery of light (or other affecting wave or field) for time durations that are much longer than one might want to sit still in front of a stationary concentrated source of radiation, e.g. a spot light source, hence a treatment involving delivery of non-thermal or tiny-thermal light energy, LHD photo modulation and other time consuming light treatments, magnetic field treatments or ultrasonic wave treatments may be implemented by the device.

The invention relates also to a kit comprising (f) the apparatus according to anyone of the disclosed embodiments and (ii) a collection of detachable radiating tips of different sizes for covering different sizes of skin lesions, and of different radiation types and for complying with various treatment requirements.

A detachable extension unit configured to be connected to the apparatus as defined in anyone of its disclosed embodiment is also within the scope of the present invention.

**Brief Description of the Drawings**

Fig 1A illustrates the Schematics of a WLTD (Wearable Light Realme Device) according to one of the preferred embodiments of the present invention.

Fig 1B illustrates the Schematics of an alternative embodiment of the WLTD (Wearable Light Realme Device) according to the present invention.

Fig 1C illustrates in cross section view an example of a multi-joint extension unit embodiment according to the invention.

Fig. 2 illustrates in a block diagram the configuration and electroics of a WLTD according to the present invention.
Fig 3. illustrates is a side view a preferred embodiment of a radiating tip according to the present invention.

Fig 4 illustrates is a side cross sectional view another preferred embodiment of a radiating tip according to the present invention.

Fig 4o. illustrates is a side cross sectional view an embodiment of a ring-shaped pad to be attached to a rim of a radiating tip e.g. by gel adhesion.

Fig 4b. illustrates is a side cross sectional view another embodiment of a ring-shaped pad to be attached to a rim of a radiating tip by an inward circumferential groove embedded in the pad.

Fig 4b. illustrates is a side cross sectional view the pad of Fig. 4b mounted on the tip of Fig 4.

Fig 6 illustrates in perspective a multi-joint gooseneck-like extension unit according to the invention, having a connector at its distal end which allows an instant replacement of radiating tips.

Figs 6ii and 6b illustrate in rear perspective radiating tips of different designs mountable on a distal end connector of the extension unit illustrated in fig. 6.

Fig 7 illustrates in perspective a preferred embodiment of a device according to the invention, comprising extension units of the type illustrated in Fig. 6 mounted to the wearable support through pivoting ports.

Detailed description of the Figsres

The invention is exemplified with reference to the schematic drawings in Figs. 1 - 7, which are not necessarily according to scale. The invention having been disclosed, variations will now be apparent to persons skilled in the art, the device is described as an example only, not to be construed in a limiting way.
Fig. 1A illustrates the treatment ergonomic of the exemplifying embodiment of the invented apparatus on a user’s face, with a preferred embodiment of a WLTD (Wearable Light Treatment Device) (100) worn on the user’s head. According to the preferred embodiment the WLTD (100) comprises a head-strap support (101) that comprises a headphone-like strap that rests on top of the head. The said head-strap will carry the energy storage batteries of the WLTD and miniaturized electronics (105), embedded in its mechanical construction.

In various preferred embodiments, the said head-strap further comprises several (at least one) fast attachment electrical-mechanical connectors (103) for connecting mechanically and electrically at least one gooseneck-like or a multi-joint light-arm (102) each carrying at its distal end a light tip (104) comprising at least one LED light or laser emitting device. It is to be noted that this is an exemplifying embodiment, thus in alternative embodiments of the apparatus using other forms of energy an appropriate source of radiation may be contained in substitution of the light emitting device, without departing from the scope of the present invention. Accordingly, whenever a specific source of radiation is referred in this specification, other types of radiation sources are mutatis mutandis referred as well. The said light-arms are preferably of the minimal acceptable weight and of different lengths thereby enable reaching with the light tips different places on the user’s face, neck and scalp where skin points requiring treatment can be found. In various preferred embodiments of the invention the light tips are of cone-like shaped housing for the LED/s or Laser emitting device, useful for protecting the user’s eye from direct and stray light. On the rim surface of a light tip the user will be able to fast attach disposable (one-time-replaceable) sponge-like circular or otherwise shaped pads that will compress to the user’s skin profile, light-seal the illuminated region and protect the user’s eye from reflected stray light, and serve also as a means of sanitation protecting the user skin from direct contact with the light arms’ tips. Optionally said sponge like pads may be coated with foam tape Sticky Gel for sticking to the user’s skin without inconvenience at their removal. In alternative embodiments the said head-strap comprise LED or laser light sources with fiber optic couplers and the said light arms comprise fiber optic light guide and fiber optic coupling optic and illumination lenses for delivering the said light from the light sources in the said head-strap to the light arm’s distal end for illuminating the user’s skin.
In yet further embodiments of the invention the WLTD further comprises, an electronic compartment for housing a part or all of the said electronics and energizing batteries. said electronic housing may be integral to the WLTD or alternatively mechanically and electrically connected to it, for example in the form of a foldable part to rest and lean on the forehead of the user. In a further alternative embodiment said electronics and batteries will be packaged in a separate miniature electronic box (108) suitable to be held in a pocket of the user’s garment or in his handbag, or attached to his body by strap or the like. Optionally, most suitable for this separate miniature electronic box configuration (108), the embodiment will comprise internal rechargeable batteries (e.g. Li Ion polymer, etc) and charger electronics, for enabling the user to connect said box to a conventional wall outlet power source, or to a USB current source, for recharging the batteries when the WLTD is not in use, thus having it always sufficiently charged for a next treatment session. Optionally the WLTD may be wired directly from a domestic wall outlet, preferably protected by an isolation transformer for user’s safety.

Optionally the said WL1D head-strap will carry a pair of speakers (106) positioned over user’s ears and audio conditioning electronics for receiving and delivering the audio signal from an external source (e.g. MP3 player, radio etc.) (107) to said speakers in order to make users feel more comfortable during treatments. Optionally the said device electronics (105 or optionally 108) will comprise Bluetooth or WiBcc or UWB or FM etc. wireless means for wirelessly receiving said audio signal from an external audio source. Optionally, as a further user comfort feature, the said WL1D will comprise or enable to attach and operate a near eye mountable video display (e.g. LCD screen, etc.) device (not illustrated) for providing the user with a visual/ audiovisual signal from any available wired or wireless source.

Fig. 1B - depict the schematics of an alternative embodiment of the WLTD (Wearable Ighl Treatment Device) deferring from the embodiment of Fig. 1A in the head-strap configuration and in making use of electrical cords as extension units, instead of the light arms of Hg. 1A. According to this alternative embodiment the WLTD is based on a forehead head-sUap support (100) that comprises several (at least one) cable connectors (110) for connecting mechanically and electrically at least one electrical cable (111) each ending with a light tip (104) Carrying at least one I.hi) light or optionally Iaser emitting or other radiating device. In various embodiments said light
tip comprise wide margins providing for increased contact area with the user's skin thus allowing for attachment to a user's skin by using either ordinary nr special made sticking pl.4cr. sticky gel, elastic band, of a combination of several or those attachment mcnn>

In this tiltsiative embodiment the electronics and batteries of the said WLTD will preferably be of the aforementioned separate miniature electronic box (108) suitable to be held in a pocket of the user's garment or in his handbag, or attached to his body by strap or the like., and connected to the said forehead strap by an electrical cord (117).

Hg. 1c illustrates in cross section view an example of a multi-joint extension unit (130) embodiment according to the invention. The extension unit (130) comprises a plurality of extension sections, e.g. (130a)-(HOh)(130c)-(130d) joined by respective friction ball joints comprising a ball part (132) situated within a ball housing (133) such that the orientation of each of said sections respective to a next section may be determined by a u&cr within predetermined 3 dimensional limits depending on the design of their joint. A connective member (131) is provided in a first end of the extension unit allowing it to be connected to a wearable support. A radiating tip (104) is connected at a free end of the extension unit (130) through a friction ball joint, as well, facilitating adaptation to the topography of a skin region to which it is to be adhered.

Fig 2 presents the Device configuration and Clectionic Block diagram of a WLTD according to the present invention. All the components presented in the drawing are available from various vendors.

The WI-TD device (201) which is based on a head-strap support having light arms or cords as extension units comprises the light generating and operating electronics as well as optional media electronics for user's fun during the treatment session.

The user will be able to control the treatment session functional parameters and features by standard UMI (Human Machine Interface) controls (216) (buttons, switches, LKD indicators, etc) connected to a microcontroller (202) that will handle the creation of modulation and control signals. The control signals (optionally modulated to generate the required energy pulse pattern) will be amplified and regulated by the LCDs/Laser Drivers (203) in order to maintain voltage / current profile required by the radiating tips.
In lim example the light sources - U Ds or Laser Light emitting devices (20.3) of any single or variable or multiple spectral wavelength, In some preferred embodiments, said driver electronics (203) is configured for automatically adapt itself to the 1,hD/s elements thereby allowing a user to switch between light-arms or light tips of different attributes., c.s. carrying different LCDs of different wavelength bands, maximal intensities, beam shapes, etc., from a collection of compatible light arms which may be offered with the W1, IiX each intended for some special treatment, e.g. a blue LED/s or a combination of Blue and Red LHVs light for acne; Red and Yellow 1 FD light for wrinkles; Red and IR 1.I.D's for scars, and the like. The sites of last attachment mechanical-electrical connectors, (e.g. (103)(1 10) and (703) shown respectively in Figs 1A, 9 B and 7) further provide the user with the capability to choose cXcMon units (i.e. light arms or cords) of different lengths, in order to easily reach treatment points on his face, neck or scalp located different distances from the respective connector sites (K)I)(1 Iü) (703) on the head-strap (IO1)(IO9) or (701.). The light emitting devices (205) will be either mounted on the distal end of the extension units (e.g. goose peak-like light arms, or cords. (204)) and optionally on the proximal end or in any mid portion thereof, or in the head-strap, with the light conducted from the light emitting device (701) to the distal end of the extension units using Tiber optic light delivery cores (206). The user, using the HMI controls (216), will be able to control the light treatment parameters such as the light intensity, modulation, wavelength to be chosen from several optional wavelengths bands provided by the W1 l, D's LEDs, alternate between said I FDA waverbands or activate all LhDs/wavebands concurrently, and the like. The light will reach the user's skin surface (208) while protecting it from contamination by using disposable sponge-like pads (207) either circular or of other chosen shape. These will also improve compression between the light tips and the user's skin profile and light-seal the illuminated region for protecting the user's eye from reflected light.

The device may be powered by replaceable (e.g. Ni-Cd, Alkaline. Ni-MH, etc.) batteries (7 14), the voltage of which may be controlled, regulated and distributed to the system by a Power Management unit (215) that may include a D1 VIX converter (Buck, Roost, Buck-Bos, or SClPIC topology) and linear regulator(s).

1 or the scope of increasing user's comfort during the treatment session, in an optional embodiment of the invention, the W1 TD will receive and deliver to the user audio from
c\ternal midio source (210) or from an optional Kl- streaming media source (209) like mobile phone, Mi\3/Mi\4, internet radio, and the like (using any standard RF protocol Bluetooth, Wilbec, WUSB, etc.). A RF transmission will be handled by standard transceiver according to RF protocol (21.1). Analog data will be shaped, conditioned and amplified by analog conditioning block (21.2) and fed into the headphones loudspeakers (21.3).

Fig 3. illustrates is a side view a preferred embodiment of a radiating lip (301) according to the present invention. The tip comprise a cone or bell shaped housing (302) interconnected by a springy member (3U3) to a connector (304) matching an opposite connector (not shown in this Fig.) located on a distal end of an extension unit (and alternatively directly, i.e. without a mediating connector, to a distal end of extension unit). Electrical wires, a wave guide or a fiber uplc (305) are/is passing through the springy portion (303) and are/is communicating from the connector (304) the energy or radiation required for the irradiation operation of the tip. The springy member (303) improves and secures the contact between the bottom edge of the housing (301) and a local topography of a user's skin surface. The shape of the springy member is tapering toward the connector (304), thus have a wide bottom end which allows for wme lateral off-set between an axis of symmetry of the housing and a longitudinal axis of the connector (304), which may become useful in establishing a stable contact with a user's skin. The springy portion (303) can be manufactured integral to and in the same plastic casting or the housing (302) and a body of the connector (304).

Fig 4, illustrates is a side cross sectional view another preferred embodiment of a radiating tip (401) according to the present invention. This tip differs from the tip (301) of Fig. 3 in that the springy portion (403) is not tapering, and is covered by a retractable sheath (406) thus providing for a telescopic movability of the housing (402) respective to the connector (AOA) and respective to the distal end of an extension unit by which it is connected. A LKD/s (407) is provided within the housing (402) and is electrically connected to the connector (404) by helical wires (405) (represented by a dotted line) which allow the housing (402) move respective to the connector (404) along a common axis, without affecting the electrical connection. A skin facing rim (408) of the tip (401) is preferably mediated to contact the skin through a spongy pad, e.g. (410) of Fig. 4a which may be removable attached to the surface (408) by gel provided on its surface.
(411). or e.g. (420) of Fig. 4b which may be removably attached to the surface (408) by an inward groove (422) formed in its spongy body (421).

Fig. 5 illustrate the pad (420) of Fig. 4a mounted on tip (401). The light irradiated from LLD/s (407) pass through the hole (423) formed in the ring shaped pad to form a treatment spot on the user's skin area to be treated, but is sealed by the spongy pad against outwards scattering.

Fig. 6 illustrates in perspective a multi-joint goose neck-like extension unit (601) according to the invention, having a connector (603) at its distal end which allows an instant replacement of radiating tips, e.g. (611) of Fig. 6a and (620) of Fig. 6b, by a mutual connector located on a friction ball joint (603a) of the respective tip. Diversity in radiating lips (in terms of shapes, dimensions and radiation specifications) will provide a set with modularity and with custom-tailored treatment capabilities. The goose neck-like extension unit (601) is made of a plurality of joint members (602), each having a longitudinal through hole (not shown) providing for a continuous passage between a connection member (604) constituting a part of a wearable support (not illustrated) and the connector (603). Electrical wires, a wave guide, or optic fibers can thus be provided within the extension unit to deliver energy and/or radiation from a source located in the support to the tip connected to the connector (603). Extension units having different number of joint members (602) may be provided, thus differ in their lengths and facilitate adaptation of the device to user requirements. The friction ball joints (603a) facilitate adjusting the orientation of the tips towards the skin, thus improve the contact between the tip and the skin.

Fig. 7 illustrates in perspective a preferred embodiment of a device according to the invention, comprising extension units (702) of the type illustrated in Fig. 6 mounted to the wearable support (701) through pivoting ports (703), each having a connector (703M) allowing for last attachment or removal of the extension units (702) through their proximal end connectors (703c) (703b) (referred to also in the present specification as "connective members"). As can be appreciated, since the present invention allows for cross linking between treatment points on the user's skin and between extension receiving ports the wearable support, a user may arbitrarily link a radiating tip, e.g. (704), to any of the extension receiving ports (703) of the support by an extension unit.
(702), then link another radiating tip, e.g. (704a) to any unoccupied one of the ports (701) by another extension unit, e.g. (702a) of appropriate length, without disrupting the previously established link/links. As can be further appreciated, the extension receiving ports (701) in the illustrated embodiment are laterally pivotable about an imaginary axis (Δ) as indicated by the arrow (R). The pivoting ability may be achieved, e.g. by a cylindrical base (703d) (illustrated by a dotted line) snugly situated within a matching cylindrical recess formed within a body of the support thus allowing for friction maintained angular positioning, or e.g. by a ratchet wheel base part (703a) situated within a matching cylindrical recess flared within a body of the support and having a tooth or teeth allowing for bi-directional ratchet-like stepwise pivoting of the port (703).
Cl AIMS

1. A portable and wearable apparatus for applying radiation onto skin locations of a user, comprising a wearable support mechanism configured to be attached over a portion of the user’s head, neck or shoulders, one or more deformable and/or flexible radiation directing arms constituting extension units each of which being attached at a first end thereof to said wearable support mechanism and which other end constituting a radiating tip is free and is adapted to radiate said radiation, control circuitry and a power source configured to activate and control radiation emitting elements provided in said wearable support mechanism and/or in said one or more radiation directing arms, wherein a direction and a shape of said one or more extension units are adjustable by the user such that their radiation emitting free ends are moveable each within a respective predetermined coverage area thus can be placed adjacent any specific point of the user’s skin to be selected by the user within said respective coverage area for applying said radiation thereto.

2. A portable and wearable apparatus, according to claim 1, wherein the extension units are conligued to allow for cross linking between points on the wearable support from which extension units protrude and points on a user’s skin to be radiated, such that an extension unit protruding at a proximal end thereof from the wearable support and is facing at its distal end a point on a user’s skin thus linking between said point of protrusion and point on the skin may be crossed over by another extension unit linking between different respective points.

1. A portable and wearable apparatus according to anyone of claims 1-2, wherein a contact area between a radiating tip and a user’s skin constitutes a fraction of between 0.01% - 25% of the coverage area of an extension unit having said radiating tip at its free end.

4. A portable and wearable apparatus according to anyone of claims 1-3, wherein at least one extension unit comprises a connector at a distal end thereof matching a connector of a radiation tip, thereby allowing for separation between the extension unit and the radiation tip and for modularity in combining between extension units and different types of radiating tips having compatible connectors.
5. A portable and wearable apparatus according to anyone of claims 1 - 4 wherein a radiating source is contained within the wearable support and wherein the radiation is delivered to the radiating tip by a wave guide contained within a respective extension unit.

6. A portable and wearable apparatus according to anyone of claims 1 - 4 wherein a radiating source is contained within at least one extension unit and wherein the radiation is delivered to the radiating tip by a wave guide, or/and an optical assembly contained within the extension unit.

7. A portable and wearable apparatus according to anyone of claims 1 - 4 wherein a radiating source is contained within at least one radiating tip and wherein energy for generating radiation is delivered to the radiating source by conductors contained within a respective extension unit.

8. The apparatus according to anyone of claims 1 - 7 wherein a body of at least one extension unit comprises a gooseneck like structure.

9. The apparatus according to anyone of claims 1 - 8 wherein a body of the at least one extension units comprises one or more joints.

10. The apparatus according to anyone of claims 1 - 9 wherein at least one extension units are detachable units, having connective members provided respectively in proximal ends thereof capable of being physically attached to matching connectors located in fixed or in rotatable ports provided in the wearable support.

11. The apparatus according to anyone of claims 1 - 10 comprising one or more radiation sources capable of emitting light, heat, magnetic field, electrical currents, mechanical vibrations or combinations thereof.

12. The apparatus, according to anyone of claims 1 - 11 further comprising one or more sensors assembled in the free ends of the one or more extension units, said one or more sensors are for monitoring skin and/or radiation parameters and are electrically linked to the control circuitry for controlling an activation regime and intensity of the radiation sources.
13. The apparatus according to anyone of claims 1 - 12 further comprising a compressible sponge like rim at (at) end of the radiating tips facing the skin for improving contact between the radiating tip and a user's skin, for tracing skin topography, and for protecting the eyes of the user from the emitted radiation.

14. A portable and wearable apparatus according to anyone of claims 1 - 13 wherein a distal end of at least one extension unit is movable respective to a mid portion of the unit through a flexible member or through a friction ball joint thereby improving contact between the radiating tip and a user's skin local topography.

15. A method for applying radiation to selected points and regions within skin areas of a user's body, comprising

attaching a wearable support mechanism over a portion of the user's body near the skin area to be radiated;
directing and adjusting at least one deformable extension unit protruding from the wearable support such that a free radiation emitting end thereof is placed against a point on the skin of the user to which radiation is to be applied; and
activating a respective number of radiation sources to apply radiation via said at least one extension unit according to a predetermined electronic program.

16. The method according to claim 15 wherein the wearable support mechanism is attached over a head, neck or shoulder portion of the user's body.

17. The method according to claim 15 wherein a control means is adapted to activate the radiation sources such that a radiation having pre-programmed characteristics serving/matching a radiating tip being used for treating a specific skin loci may be selected by the user from a menu and applied to the radiating tip respectively.

18. The method according to claim 15 further comprising choosing and attaching to an extension unit a specific radiation tip having characteristics especially adapted for treating a particular skin lesion.
16. The method according to claim 15 wherein at least one extension unit is detachable and wherein the method further comprises a step of protecting a specific number of said at least one unit according to a number of separate skin regions to be treated.

20. A kit comprising the apparatus according to anyone of claims 1-14 and a collection of detachable radiating tips of different sizes for covering different skin/lesions, and of different radiation types and characteristics for complying with various treatment requirements.

21. A de-formable extension unit configured to be connected to the apparatus as defined in anyone of claims 1-14.
Fig. 2
INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER
INV. A61N1/00 A61N5/06

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 practical, search terms used)
EPO-Internal, WPI Data

C DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>paragraph [0005] - paragraph [0006]</td>
<td>5, 6,</td>
</tr>
<tr>
<td></td>
<td>paragraph [0021]</td>
<td>12-14</td>
</tr>
<tr>
<td></td>
<td>paragraph [0028] - paragraph [0029]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>paragraph [0035]; figures 4, 9</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>WO 01/36869 A1 (FAIRMAN JULIAN DOUGLAS [GB]; FAIRMAN HUGH DOUGLAS [GB]; GORE THIERRY E) 25 May 2001 (2001-05-25)</td>
<td>5, 6,</td>
</tr>
<tr>
<td></td>
<td>page 5, line 24 - page 6, line 14; figures 1-7</td>
<td></td>
</tr>
</tbody>
</table>

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 document 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

'I' 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

'N' document member of the same patent family

Date of the actual completion of the international search 6 July 2010

Date of mailing of the international search report 13/07/2010

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 Gentil, Tamara
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>CN 2 232 780 Y (LIU CHENGXIANG [CN]) 14 August 1996 (1996-08-14) the whole document</td>
<td>1</td>
</tr>
</tbody>
</table>
INTERNATIONAL SEARCH REPORT

**Observations where certain claims were found unsearchable** (Continuation of item 2 of first sheet)

<table>
<thead>
<tr>
<th>Box No. II</th>
<th>Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Claims Nos.: 15-19 because they relate to subject matter not required to be searched by this Authority, namely: Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy</td>
</tr>
<tr>
<td>2.</td>
<td>Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:</td>
</tr>
<tr>
<td>3</td>
<td>Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).</td>
</tr>
</tbody>
</table>

**Observations where unity of invention is lacking** (Continuation of item 3 of first sheet)

<table>
<thead>
<tr>
<th>Box No. III</th>
<th>Observations where unity of invention is lacking (Continuation of item 3 of first sheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This International Searching Authority found multiple inventions in this international application, as follows:</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</td>
</tr>
<tr>
<td>2.</td>
<td>As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.</td>
</tr>
<tr>
<td>3.</td>
<td>As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:</td>
</tr>
<tr>
<td>4.</td>
<td>No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:</td>
</tr>
</tbody>
</table>

**Remark on Protest**

| The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee. |
| The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation. |
| No protest accompanied the payment of additional search fees. |

Form PCT/ISA/21.0 (continuation of first sheet (2)) (April 2005)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 2004230259 A1</td>
<td>18-11-2004</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>CN 2232780 Y</td>
<td>14-08-1996</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>UO 8908476 A1</td>
<td>21-09-1989</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>