

Device providing protection against insect bites without modifying the ecological balance

It is the aim of the invention to play its part in the protection from insect bites and thus to counteract the spread of infectious diseases without changing the ecological balance.

For this purpose the invention is defined by the features specified in claim 1.

The device according to the invention is accordingly designed as a module 1 which contains two oscillators 2, 3, which produces oscillations at different frequencies and to which in each case there is coupled a linear amplifier stage 4, 5. The transformatoric functions are assumed by the two associated body antennae 6, 7 which in the test samples are designed as a one-sided, gold-coated, epoxy plastic platelets with the dimensions length: 5 millimetres, width: 10 millimetres, thickness: 0.3-millimetres shown in Fig. 7 which transforms oscillations onto the surface of the human or animal epidermis, wherein the two-separate oscillations superimpose. After the transformation the superimposed surface waves propagate on the complete surface of the epidermis 14, wherein the blood-circulated corium 15 and the subdermis 16 with their cell tissue serve as a potential earth mat 17. The applied oscillating frequencies have a low absorption in the biologically constructed skin, and by way of this the energy is not converted into heat but is available for the propagation. The intensity of the oscillations which in the test samples lay at 1.2 KHz and 64.0 KHz may therefore be kept small so that it falls short of the allowable maximum irradiation onto the body surface of 1mW/cm^2 by tenfold given a baby with an average size and weight.

The blood-sucking female mosquitos 18 obtain food from living animals and humans by sucking up blood from the blood-

leading corium 15 with their proboscis. In order to carry out this act the mosquitos come into contact with the surface of the epidermis 14 on which the superimposed surface waves 13 propagate. The extremely sensitive sensilla 19 which are distributed over the whole insect body however are concentrated at certain locations, thus at the antennae, the mouthparts and the feet, react to the superimposed surface waves 13 which are matched to their resonance frequencies 20. The oscillations are converted into stimulus flows by sensory cells 21, the biochemical 22 and mechanical 23 stimuli, and are adequately supplied via the nervous system 24 to the tripartite supra-esophageal ganglion 25 (brain). Via the explication nerve system 26, and the nerve nodal point 27 the obtained information is transmitted to the muscle motor system 28 which amongst other things indoctrinate the control process for the proboscis. The mosquito in its intention to remove blood is disturbed and departs from the skin surface.

In order to obtain a reliable coupling of the body antenna to the surface of the epidermis 14 the modul 1 is placed in the base 31 of a wrist watch 30. By way of the low current uptake of 1.2 mA to 3.6 mA with an operating voltage range of 1.2 Volts to 1.6 Volts, the module may be supplied via the two contact springs 32 with the operating voltage which originates from a watch battery 33. Fig. 1, Fig. 3. With mechanical watches without battery supply the module is supplied with the operating voltage by an integrated battery 8. The module may also be integrated into jewellery which is carried directly on the body such as for example wrist jewellery, necklace pendants, Fig. 3 or ear clips Fig. 12, wherein the wrist strap (bracelet) or the neck chain are designed as body antennae 6, 7. The module 1 is equipped with a solar cell 9 which may charge an integrated battery 8 or a charge capacitor with a flat construction during daylight in order to maintain a continuous 24 hour operation. Fig. 4. Furthermore in place of the battery a miniaturised movement generator may be incorporated which via a battery 8 or a charge capacitor supplies the module with the necessary

operating voltage. Fig. 6. If the module 1 is designed as an ear clip the underside of the clip forms the body antenna 6,7. Fig. 13. This application is suitable also for mammals. The current supply originates from an integrated battery 8 which is charged by a solar cell 9. For larger mammals or free-living animal species the device is designed as a projectile cell 36 which may be shot from an air rifle. An internal battery supplies the module 1 for four years with the necessary supply voltage. Fig. 13.

State of the art

Every year more than 300 million people are affected by the different forms of malaria and yellow fever. These belong to the most frequent infectious diseases in the world and after initial declines are spreading again. In spite of all protective vaccinations, yearly 20 million people die - more than ever before. These so-called vector diseases are transmitted to humans and mammals by way of the bite of female mosquitos; malaria by the genus *Anopheles*, yellow fever by the genus *Aedes aegypti*. These two were only prevalent in the tropics.

The World Health Organisation of the UN prophesied in 1951 that one would conquer these fever diseases in a short time, thanks to new medicine and the insecticide DDT. However soon the number of cases of diseases drastically increased. Malaria and yellow fever viruses are in the meantime largely resistant to antibiotics. One already recognises 27 *Anopheles* species - half of these dangerous malaria transmitters which are immune to modern insecticides. Amongst this is the *Anopheles gambiae* which in tropical Africa threatens more than 90% of the population. Furthermore the transmitter mosquitos are spreading on account of climate change. Millions of people on our planet are exposed without protection to these life-threatening diseases. The fight against the transmitters of these human plagues is becoming more

and more urgent. By way of global travel today almost every person is at danger of being infected by mosquitos.

Microwave apparatus are in the position of combatting mosquitos but however only with a large irradiation intensity, which - with a multiple of the allowable irradiation burden on the human and animal body - may cause enormous damage to the organs of the human and animal. From air ultrasound apparatus there comes contradictory reports of success of "combatting" mosquitos within a room. Physically these apparatus are not suitable in the open air since air ultrasound may only propagate in a directed manner in an atmosphere which is completely still from wind. In order to protect humans in the open air against mosquitos with ultrasound absolute calm must prevail - the person may not move since with this he creates air movements - and the sound output drastically increases. With an increased sound pressure (irradiated sound intensity) it could be ascertained that they may trigger various reactions in the human body, amongst other things causing headache and sickness.

(The inventor already in the year 1975 has filed a patent for an air ultrasound -apparatus for "Combatting and Discouraging Mosquitos" as well as in the year 1977 for a microwave apparatus for the same application, but not processed further with these).

Apparatus which emit an even more audible tone in order to keep mosquitos away from humans at the most are suitable for an apparatus which disturbs sleep, wherein possibly there exist the chance of attracting male mosquitos which with their sensillas may detect the flying noise of the female mosquitos. Female mosquitos which require a blood meal and suck this with their proboscis from the human or animal epidermis may not receive any sound waves.

Description of the reference numerals

1. modul (module construction form)
- 2 oscillator or generator
- 3 oscillator or generator
- 4 amplifier stage
- 5 amplifier stage
- 6 body antenna (transformatoric element)
- 7 body antenna (transformatoric element)
- 8 battery, button cell or plate cell in thick-film technology, equivalent design charge capacitor
- 9 solar cell
- 10 movement generator, miniaturised
- 11 modulator unit
- 12 generator or oscillator
- 13 surface waves or oscillations
- 14 epidermis (human)
- 15 corium (human)
- 16 subdermis (human)
- 17 earth mat, shown symbolically
- 18 insect shown as a female mosquito
- 19 sensillas of an insect, greatly enlarged
- 20 resonance oscillations at the sensillas
- 21 sensory cells (insect)
- 22 biochemical stimulus (insect)
- 23 mechanical stimulus (insect)
- 24 nerve line (insect)
- 25 upper pharyngeal ganglion (insect brain)
- 26 explication nerve line (insect)
- 27 nerve node point
- 28 muscle motor system (insect)
- 29 proboscis (consisting of upper and lower lip)
- 30 wrist watch (battery operation)
- 31 wrist watch base
- 32 contact spring (positive and negative voltage supply from the watch battery)
- 33 watch battery cell

- 34 not specified
- 35 chip (integrated components and circuits: oscillator 2, 3, amplifier stage 4,5 with or without modulator 11, generator 12 and body antenna 6,7)
- 36 projectile cell with stabilisers (automatically remove themselves on penetrating into the skin surface)
- 37 projectile tip

Description of the figures

- Fig. 1 a representation of the procedural course of the device (basic representation)
- Fig. 2 a representation of the biological function process (female mosquito)
- Fig. 3 integration of the module with the example of a wrist watch or a neck chain with pendant
- Fig. 4 to
- Fig. 6 block diagram of the device
- Fig. 7 cross section drawing of the construction of the body antenna (transferring element)
- Fig. 8 cross section drawing of the modular construction manner without current supply
- Fig. 9 cross section drawing of the modular construction manner with its own power supply by way of solar cells and chargeable battery
- Fig. 10 a cross section drawing of the modular construction manner with its own power supply by way of a movement generator and chargeable battery
- Fig. 11 a cross section drawing of the modular construction manner with its own power supply by way of a battery cell (chargeable or exchangeable)
- Fig. 12 construction as an ear clip
- Fig. 13 construction as a projectile cell

Patent claims

1. A device for the protection from insects and their bites, characterised by one or more oscillators or generators which produce differing oscillations as well as the transferring elements which transfer these oscillations onto the human skin surface in order to bring the sensilla and stimuli of insects in resonance oscillations.
2. A device according to claim 1, characterised in that modulated waves are produced.
3. A device according to claim 1, characterised in that one or more mechanical or biomechanical oscillators are designed as transferring elements.
4. A device according to claim 1, characterised in that one or more hollow space resonators are designed as transferring elements.
5. A device according to claim 1, characterised in that all components which are necessary for operation are integrated in an exchangeable module.
6. A device according to one of the preceding claims, characterised in that all components and circuits which are necessary for operation are implemented in a chip.
7. A device according to one of the preceding claims, characterised in that it is conceived for therapeutic and medical applications.
8. A device according to one of the preceding claims, characterised in that the chip is implanted into the epidermis.



9. A device according to one of the preceding claims, characterised in that the chip or the module is integrated into a wrist watch or into body jewellery.
10. A device according to one of the preceding claims, characterised in that the chip or the module is designed as a projectile, or is integrated into a projectile cell.

