A device for use in phototherapy is provided with a thin film electro luminescent (TFEL) device (1) having at least one light-emitting surface.
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Device for use in phototherapy

The invention relates in general to a device for use in phototherapy, to be worn by a user.

More specifically the invention relates to such device, which can be self adhering.

Light, particularly IR and/or red light, is known to have beneficial effects on the human body. In patent application US2004/0166146 A1 a bandage is described that may be applied to the skin of a patient, wherein a thin film electro luminescent (TFEL) device is provided. This TFEL device emits light to the skin for phototherapy treatment. The invention as described in said patent application does not provide with satisfactory measurements for a dedicated, hygienic and user-friendly solution to the application of phototherapy.

A goal of the invention is to provide a more dedicated, user friendly and hygienic device for phototherapy.

These goals are achieved by a plaster according to the invention; having a side for adhesion, wherein a thin film electro luminescent (TFEL) device is provided having at least one light-emitting surface.

A plaster according to the invention may be disposed after it has been used for a sufficient time and, if necessary, another may be readily applied. In this way the invention may provide a user friendly and hygienic use of phototherapy. The invention may be applied by home users as well as professionals, for example in a hospital. Combination of an OLED with a plaster makes it very suitable for selling in drugstores, chemist's, supermarkets and/or other stores. This makes the invention next to healing also very suitable for aesthetic treatments, such as possible improvement of the skin.

The plaster can for example be dedicated to the type of treatment and/or skin surface.

The plasters may be flexible in shape and size to be applied to practically any outer part of the body so that a large variety of treatments are suitable within the scope of the invention. In an advantageous embodiment the TFEL device comprises a thin film Organic Light Emitting Diode (OLED) device.
A sheet according to the invention is preferably dividable into multiple plasters wherein each of said multiple plasters has electrical power source connecting means and/or can be provided and/or connected with one or multiple TFEL devices.

Furthermore the invention provides a plaster, having connecting means for an electrical power source and/or a TFEL device, wherein the plaster is advantageously at least partly transparent, such that the skin and/or area to be treated under said plaster and possibly under said TFEL device can be seen.

The invention also provides a set of an electrical power source and a TFEL device, which may be readily applied to the skin in combination with adhesion means, such as a separate plaster. Within the scope of the invention, certain parts, such as the TFEL device, adhesion means, such as a 'conventional'-like plaster, and batteries may be combined in multiple advantageous ways.

Furthermore the invention provides a TFEL device, having an adhesion side, especially for adhering to skin and/or to a plaster, which may be applied, to the skin. The TFEL device may comprise power source connecting means and a sheet of TFEL devices which is readily dividable into multiple TFEL devices, each having power source connecting means.

Furthermore the invention also provides a method for manufacturing a plaster with a TFEL device, wherein a TFEL device is positioned on a plaster, preferably on a skin attachment side of the plaster.

The invention provides for use of a TFEL device, wherein the TFEL device is positioned on a skin by aid of a plaster, wherein a power source is connected with the TFEL device.

Furthermore the invention provides for a kit of parts, comprising a plaster, a TFEL device and a battery.

Brief description of the drawings:

Fig. 1 is a schematic drawing of an OLED technology principle;

Fig. 2 is a sketch of a plaster according to the invention;

Fig. 3 is a sketch of a plaster according to the invention, applied to the skin;

Fig. 4 is a sketch of a front view of a plaster according to the invention;

Fig. 5 is a sketch of a sheet that is dividable into multiple plasters according to the invention;
Fig. 6 is a sketch of a sheet that is dividable into multiple OLED's according to the invention; and

Fig. 7 is a sketch of a kit of parts according to the invention.

In this description, identical or corresponding parts have identical or corresponding reference numerals. The exemplary embodiments shown should not be construed to be limitative in any manner and serve merely as illustration.

Light, particularly IR and/or red light, is known to have beneficial effects on the human body such as, but not limited to, effective relief of muscular pains and stiffness of the joints; removal and/or reduction of bacteria, for example in ulcers or acceleration of wound repair; stimulating the fibroblasts for collagen production, for stabilizing connective tissue and healing wounds, for example burn wounds; light induced blood vessel and lymph vessel vasodilatation for possible aiding in cellulite treatment; inflammation like eczema; etc.

By applying light, i.e., photo therapy, a stay in a hospital after an accident or surgery can be shortened and the recovery for example at home can be accelerated. Aesthetic therapy, for example possible improvement of the skin, may also profit from phototherapy.

Wound healing as well as other healing processes are oftentimes-delicate processes, where careful monitoring of the progress and possible inflammation of the skin is needed. This process may benefit from dedicated phototherapy. Therefore different types of light parameters like wavelength, brightness, color, pulse duration, intensity, etc. may be applied to the wound during different stages of the healing process in time. A specific wavelength or other parameter may induce optimal stimulation of specific cells that are active at a certain time in the healing process. For example, different stages in wound healing may consist of collagen production, regeneration of vessels and formation of the epidermis, which can be stimulated by specified wavelengths or other specified parameter with the aid of control means. A control means for dedicated phototherapy can be applied to any type of healing process and/or treatment that may benefit from phototherapy.

Examples of beneficial wavelengths for stimulation of particular cells are known in the art of phototherapy. In advantageous control means, specific wavelengths and/or other parameters may be applied to said particular cells at a specific time. This might be controlled by a person or automatically. It might be advantageous to monitor the state of a certain area under treatment and give feedback to the control means. An optimal
phototherapy treatment may be provided by linking the right parameters and anticipating on using different kinds of light.

Especially electro luminescent (EL) devices or thin film electro luminescent (TFEL) devices are light sources that have proper temperature and construction properties, may be relatively thin and are relatively free in shaping, which makes them suitable for appliance near the skin for photo therapy. LEDs (Light Emitting Diodes) and especially OLED (Organic Light Emitting Diodes) devices are preferred embodiments of electro luminescent (EL) devices suitable for phototherapy near the skin. EL devices may have excellent control properties to vary parameters such as wavelength, brightness, color, pulse duration, intensity, etc. and can be made suitable to be fed by portable electrical current power sources.

An example of Organic Light Emitting Diode (OLED) technology is a technology wherein organic material 2, 3 is sandwiched between two thin electrodes 4, 5. A principle of an OLED device is schematically illustrated in figure 1. When an electrical current flows through the device, electrons and holes may recombine and emit light. OLED devices can be made relatively flat. With the aid of thin film encapsulation for example, the device 1 can be limited in thickness to less than 0.5 mm. Generally, in OLED applications the thickness is determined by the substrate 6, which can be made of transparent materials such as glass or flexible foil. Special characteristics of OLED devices are that they can be made flexible and transparent. In principle, the form factor is free and determined by the substrate 6.

An OLED light source could be made 'wearable' and could be customized in size and shape. For example, OLED devices could be designed to serve relatively large body areas like the back or legs and/or relatively small areas for very local treatment of inflammation effect on the skin like eczema. A battery 9 can be connected to the OLED device so that the OLED device can be carried (worn) while emitting light during relatively long periods of time, such as hours, days, weeks or longer.

In a preferred embodiment the OLED device is carried like a known 'conventional' plaster during usage, so that it may be conveniently applied to the body and disposed after usage. This will insure a very user friendly and hygienic usage of the OLED device. An advantageous example of an embodiment of a plaster 11 according to the invention is schematically illustrated in figure 2. Note that the thickness of the OLED device 1 that is shown in figure 2 may have been exaggerated. Plaster 11 as shown in figure 3 may be a part of a multiple plaster sheet 10. Before usage a plaster 11 can be cut off from the
sheet 10, for example near a cutting line 14. A plaster 11 can also be teared off from the sheet 10 near for example a perforated line 14 or another type of line 14. It's also possible to for example cut or tear off a plaster without using a line 14. These and other possibilities of the like will be recognized by those who are skilled in the art as possible embodiments of the invention. In principle, because of the design freedom of OLED devices 1, the sheet 10 of plasters 11 can be designed into any shape and/or form. This makes it possible to for example pre-shape the plaster 11 to cover large as well as small parts of the body at places that are easy or difficult to reach. A large sheet 10 may be provided which can be divided, for example by cutting, into multiple fully functioning plasters 11 according to embodiments of the invention. In this way it is possible to treat large back burns as well as small facial wrinkles for example, by means of the same sheet 10 or parts thereof.

Adhesive layers 12 are provided at the plaster 11 and are covered with small cover sheets 13 to prevent dirt from sticking to it as in conventional plasters. The cover sheets 13 can be taken off easily so that the adhesive layer 12 is uncovered. After cutting off the plaster 11 and uncovering the adhesive layer 12 the plaster 11 may be applied to the skin, for example as shown in figure 3. Also schematically shown in figure 3 is a small battery 9 that is positioned on the plaster 11, which is adhered to a patient/consumer 20. This battery 9 can be connected with the OLED device 1 to provide electricity. As shown in figure 2 two printed electrodes 4, 5 are provided on the plaster 11, which are connected with the electrodes 4, 5 for the OLED device 1 which is incorporated in the plaster 11. The battery 9 has two electrodes 7, 8 that can be connected with the plaster electrodes 4, 5 to provide an electrical current through the OLED device 1. For example the electrodes 4, 5 can be positioned partly or fully on a face opposite the face attachable to the skin, so as to allow connection to the power source 9, such as the battery 9 after placing the plaster 11. It is also possible to have said electrodes on the side facing said skin, in order to cover the battery 9, which might for example be fixed to and/or integrated with an OLED device 1 and covered by the plaster 11. It can be advantageous to have the electrodes 4, 5 accessible form both surfaces, for example by intertwining said electrodes 4, 5 through said plaster, for allowing the user a choice of positioning of the power source 9. It will be clear to those skilled in the art that there are many ways to connect and position the electrodes 4, 5 in a favorable way, so this will not be explained into detail. Battery fixation means, such as for example an adhesive layer 17 and cover sheet 13 shown in figure 4 may also be provided on the top of the plaster 11, near to the electrodes 4, 5, to fix and/or connect the battery 9 temporarily to the plaster 11. Other fixation means may also be provided or may be improvised on the spot. Examples
of battery fixation means for fixation to the plaster 11 or to the body may comprise velcro, tape, clips, elastics, straps, etc. The battery 9 can for example be rechargeable and it can be connected with multiple disposable plasters 11 so that plasters 11 can be regularly changed and hygiene can be advantageously maintained. For this, it is favorable if the battery 9 may be taken off for recharging or to change the battery 9. As shown in figure 4 the OLED device 1 may emit IR light 15 in the direction away from the plaster 11. When the plaster 11 is in 'fixed' position the light will favorably fall on the skin of the patient/consumer 20. From the above it is clear that the battery 9 preferably can be separated from the plaster 11, preferably without damage to the plaster 11 and/or battery 9.

OLED device 1 may be provided with one or more preferably relatively thin layer(s) 18, which may be constructed to serve as a hygienic protection for the skin from the OLED device 1 and/or to protect the OLED device 1 from the conditions of the skin. In an embodiment, a transparent (light permeable) gauze or cushion may be provided at least at the light emitting side of the OLED device 1. The layer 18 may be sterile and at least partly transparent. In an embodiment, the OLED device 1 may be thin film encapsulated by the layer 18 and may be sterile, which makes it possible, for example, to make the OLED device 1 exchangeable or to directly apply the OLED 1 device to the skin by aid of an adhesive, that is either with or without a plaster 11. Depending on the configuration of the embodiment of the invention, a battery 9 may be connected to or inseparably integrated with the OLED device 1 or it may be readily separable from the OLED device 1.

Plaster 11 may have the features that known 'conventional' disposable plasters may have, such as, but not limited to, anti-skeptical and/or cleaning means; a moisture absorption layer, for example by aid of a cushion and/or gauze; air permeability; adhesive 12 with removable covers 13 for adhesion; flexibility; etc. These and other aspects may contribute to the user friendliness, hygiene, etc. of the phototherapy. An embodiment of the plaster 11 according to the invention may be aimed at home consumers for example.

For hygienic reasons the plaster 11 carrying a first OLED device 1 may be disposed after usage and a new plaster 11 carrying a second OLED device 1 may be applied. The second OLED device 1 may be of the same type or of a different type, for example, depending on the desired wavelength. The same or another battery 9 may be used.

The battery/power supply 9 of the TFEL may be about as thin as the lighting device itself. Battery 9 may be an exchangeable battery 9, so that it is possible to re-use the battery 9 multiple times, or it may be integrated with the OLED device 1, depending on the preferred type and/or usage. The battery 9 may be any type of battery 9, for example a
chemical type of battery 9, but also for example a capacitor or any electrical power source that may provide electrical current through the OLED device 1. Examples of electric power suppliers may be various kinds of NiMH systems. Li-ion systems and fuel cells may also be provided. For example, in the case of Li-ion the 'conventional' types may be used and also the polymer and gel type systems. Solid-state batteries may be desirable, for example because of no leakage, and these can for example be provided on rigid substrates, or onto flexible (polymer) substrates or other types of substrates. For a skilled person it will be clear that within the scope of the invention multiple power sources might be suitable.

In a preferred embodiment, lithylene batteries 9, preferably rechargeable, may be applied to the OLED device 1. Advantageously, these systems can be preshaped and fully integrated into the plastic and/or electronic housing of practically any shape. This type of battery 9 can in principle be shaped to any desired form and have a thickness of for example approximately 1 mm. Power supply might be approximately 3.8 V and the lithylene batteries can for example be put in series to increase the voltage if higher brightness levels were commercially or therapeutically interesting. A typical lithylene battery 9 may for instance supply approximately 1200mAh and may supply electrical current for approximately 4 hours to a polyed that has a surface of approximately 100 cm² and emits light at approximately 50 Cd/m².

One of the advantages of lithylene batteries 9 is that these batteries 9 can easily be stacked and thus the operating time of the plaster 11 may be extended. Furthermore lithylene batteries 9 allow an advantageous freedom in design and the battery 9 can for example be provided on the border of the OLED device 1. The combination and/or connection of the battery 9 and the OLED device 1 is preferably relatively solid and will stay connected to the skin during heavy movement, for example in sports, and/or when it bumps against objects and/or when it is caught between loads, for example when a person 20 sits on the plaster 11.

In certain embodiments the battery 9 may be fixedly connected and/or integrated with the OLED device 1, for example, so that it may be disposed together with the OLED device 1 after usage. Also the plaster 11 might be provided with electricity by other means than a battery 9, such as the local electrical network, solar energy, etc. For the skilled person it will be obvious that the described examples of the batteries/power sources 9, the OLED devices 1 and its features merely serve as an indication for the possibilities of the invention and/or its embodiments.
Preferred embodiments of plaster 11 may be advantageously provided in a sheet 10. This is illustrated in figure 5. A sheet 10 may be provided and can be divided into a number of desirably shaped plasters 11 of any surface size. For example a relatively small burn of the finger may be treated with a relatively small plaster 11 cut out of the sheet 10 and a relatively large wound on the back of a patient 20 may be covered with a relatively large plaster 11 cut out of said sheet 10, wherein said small plaster 11 may have a surface of about 2 cm² and said large plaster 11 may have a surface of about 200 cm², both corresponding with the area to be treated. Of course, these examples serve merely as an indication, whereas larger and smaller plasters 11 corresponding with an area to be treated may be advantageous within the scope of the invention.

In an advantageous embodiments the plasters 11 and/or OLED devices 1 that are separated from the sheet 10 each have sufficient connecting means for the battery 9, such as electrodes 4, 5. The sheet 10 may be constructed in such a way that the different sizes of the plasters 11 are not pre-determined and may be of practically any shape, for example having a surface between 0,5 cm² and 1 m². One of the advantages of OLED technology is that two electrodes are sufficient for a functioning OLED device 1, which makes it possible that relatively small as well as relatively large plasters 11 may be readily separated from the sheet 10 without loosing any of the functionalities of a plaster 11 according to the invention. For example, the electrodes 4, 5 may cover a large part of the sheet 10 on each of the opposite sides of the organic material 2, 3, wherein each electrode 4, 5 may be readily connected with a power supply 9 after separation from the sheet 10.

For dedicated treatment different sheets 10 may be provided wherein the OLED devices 1 may vary in wavelength, intensity, brightness, color, pulse duration, and/or another advantageous parameter. For a different type of treatment a plaster 11 from a different sheet 10 may be used. In another embodiment of the invention it's be advantageously possible to vary the parameters within one plaster 11/sheet 10, for example with the aid of control means. Power supplies 9 may be integrated with the sheet 10 and may be separately connectable as well.

It is also possible that the plaster 11 comprises OLED devices 1, which can be applied directly to the body. For example, an adhesive might be applied directly to the OLED device 1. A schematic illustration of a sheet 10 of OLED devices 1, which are directly applied to the body, is shown in figure 6. The sheet 10 of OLED devices 1 may be divided into multiple working plasters 11/OLED devices 1 as discussed before in relation to figures 1 - 5.
As shown in figure 7 a kit of parts, for example comprising at least an OLED device 1, a battery 9 and a protective/adhesive layer 19 may be provided. In this way said parts may be put together according to preference, so that it functions as a plaster 11. The OLED device 1 might be encapsulated with a thin film layer 18 and might be sterile. This may ensure a hygienic use of a readily applicable plaster 11. For this, it might be advantageous that an extra protection layer is provided that preferably is not removed earlier than right before usage. Furthermore it might be advantageous to construct the OLED device 1 at least partly transparent. The separate OLED device 1 as illustrated, might be pressed against a person's body by the protective/adhesive layer 18. In an embodiment protective/adhesive layer 19 may be partly or fully transparent, for example to be able to see the position of the OLED device 1 and/or area to be treated for relatively easy positioning of the layer 19, or to be able to verify changes in the area to be treated in time through the layer 19 and/or OLED device 1. The layer 19 may comprise electrodes 4 - 8 for connecting the battery 9 and the OLED device 1. The battery 9 and OLED device 1 may be provided at different sides of the layer 19 or the same side. The battery 9 and the OLED device 1 can be connected by the electrodes 4 - 8 in many ways, which can be readily chosen by the skilled person. Obviously the layer 19 may comprise an adhesive layer 12 for sticking to the skin and the cover sheets 13, like a normal plaster. It will be clear to a skilled person that layer 19 may also be constructed so that it may be separated from a kind of dividable sheet 10 or the like.

Like aforementioned control means can be advantageously applied for phototherapy. Plasters 11 and/or OLED devices 1 can be exchanged to vary certain parameters, for example wavelength and/or brightness, during different stages in the healing process. Wavelengths, or other parameters can be varied either by using different OLED devices 1 or wavelengths may be varied within the same OLED device 1. Layers of OLED devices 1 may be stacked in at least one plaster 11, wherein particular layers for example may act as (light)filters, and/or may provide different wavelengths, pulses, intensities, colors, temperatures, brightnesses etc., such that they may be selected at will by a person and/or are automatically selected. Also different OLED devices 1 may be provided next to each other, as shown in figure 6. Different OLED devices 1a, 1b can be selected, for example within a plaster 11 and/or sheet 10. In such and other cases, the different OLED devices 1 may function optimally for specific parameters like wavelength and/or other parameters.

The patient 20 may change the plasters 11 him-/herself according to a corresponding parameter. However, this may also be preprogrammed in a single or multiple
plasters 11 and/or OLED devices 1. Also one or multiple plaster(s) 11 and/or OLED device(s) 1 may be provided with a microprocessor and/or control means so that the plaster 11 may provide a dedicated treatment, wherein the wavelength, or another parameter, may change in relation with time. It is also possible to couple a monitoring means with the control means so that the monitoring means might provide the control means with feedback and the control means can actively react to that by changing a parameter correspondingly and/or outputting a signal.

In other embodiments the OLED device 1 and/or plaster 11 may be permeable for bodily fluids. In which case for example a 'conventional' plaster or bandage may cover the plaster 11. Also a reflecting layer may be provided in the plaster 11, for example for intensifying and/or reflecting the emitted light against the area to be treated.

In this description it has been made clear that a plaster 11 may also comprise an OLED device 1 which can be positioned on the body 'like a conventional plaster' for the use of photo therapy.

It shall be obvious that the invention is not limited in any manner to the exemplary embodiments that are represented in the description and the drawings. Many variation are possible within the framework of the invention as outlined by the claims. The figures are not necessarily on an actual scale, for example thicknesses have been exaggerated, for the sake of clarity. All comparable variations are understood to fall within the framework of the invention as outlined by the claims.
CLAIMS:

1. A plaster, having a side for adhesion, wherein a thin film electro luminescent (TFEL) device is provided having at least one light-emitting surface.

2. A plaster according to claim 1, wherein the TFEL device comprises an OLED device.

3. A plaster according to claim 1 or 2, having separate TFEL devices.

4. A plaster according to any one of the preceding claims, having different types of TFEL devices.

5. A plaster according to any one of the preceding claims, having at least one protective layer covering the or each TFEL device, especially over the said light emitting surface of each TFEL device.

6. A plaster according to any one of the preceding claims, wherein at least one TFEL device is separable, from said plaster.

7. A plaster according to any one of the preceding claims, wherein said at least one TFEL device is encapsulated.

8. A plaster according to any one of the preceding claims, wherein said at least one TFEL device is at least partly transparent.

9. A plaster according to any one of the preceding claims, wherein said at least one TFEL device and/or the side for adhesion is sterile.

10. A plaster according to any one of the preceding claims, which is at least partly transparent.
11. A plaster according to any one of the preceding claims, having power source connecting means.

12. A plaster according to any one of the preceding claims, comprising at least one electrical power source.

13. A plaster according to claim 12, wherein the at least one electrical power source is a lithylene battery.

14. A plaster according to claim 12 or 13, wherein the at least one electrical power source is rechargeable and/or replaceable.

15. A plaster according to any one of the preceding claims, having connecting means for control means for said at least one TFEL device.

16. A plaster according to any one of the preceding claims, having control means for said at least one TFEL device, especially for varying the wavelength and/or other advantageous parameters emitted by said at least one TFEL device.

17. Sheet that is dividable into multiple plasters according to any one of the preceding claims, wherein each of said multiple plasters has electrical power source connecting means.

18. Sheet that is dividable into multiple plasters, each dividable plaster having connecting means for an electrical power source and/or TFEL device.

19. Sheet according to claim 18, wherein the TFEL device comprises an OLED device.

20. A plaster, having connecting means for an electrical power source and/or a TFEL device, which plaster is transparent.
21. A plaster according to claim 20, wherein the TFEL device comprises an OLED device.

22. Sheet that is dividable into multiple plasters according to claim 20 or 21.

23. Set of at least an electrical power source and a TFEL device, for a plaster according to any one of the preceding claims.

24. Set according to claim 23, wherein the TFEL device comprises an OLED device.

25. TFEL device, having an adhesion side, especially for adhering to skin and/or a plaster.

26. TFEL device according to claim 25, wherein the TFEL device comprises an OLED device.

27. TFEL device according to claim 25 or 26, wherein the TFEL device comprises adhesive at the light emitting side of the TFEL device.

28. TFEL device, especially any one of the claims 25 - 27, having power source connecting means.

29. TFEL Device according any one of the claims 25 - 28, which is encapsulated.

30. TFEL device according to any one of the claims 25 - 29, which is sterile.

31. Thin film TFEL device according to any one of the claims 25 - 30, which is at least transparent.

32. Sheet of thin film TFEL devices, which is dividable into multiple TFEL devices according to any one of the claims 25 - 31.
33. Method for manufacturing a plaster with a TFEL device, wherein a TFEL device is positioned on a plaster, preferably on a skin attachment side of the plaster.

34. Method according to claim 33, wherein the TFEL device comprises an OLED device.

35. Method according to claim 33 or 34, wherein an electrical power source is electrically connected with the TFEL device.

36. Use of an TFEL device, wherein the TFEL device is positioned on a skin by aid of a plaster, wherein a power source is connected with the TFEL device.

37. Use according to claim 36, wherein the TFEL device comprises an OLED device.

38. Use according to claim 36 or 37, wherein the TFEL device properties are varied during time, especially in relation to a treatment of a subject.

39. Use according to any one of the preceding claims 36 - 38, wherein the electrical power source is placed near the skin near the TFEL device.

40. Use of a TFEL device, especially an OLED device, in the manufacture of a plaster, especially for manufacturing a plaster according to any one of the claims 1 - 16.

41. Kit of parts, comprising a plaster, a thin film TFEL device, especially an OLED device, and a battery.
FIG. 1
INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/054023

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61F13/02

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)
A61F

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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D. Further documents are listed in the continuation of Box C

See patent family annex

“+” 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

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